Inequities and Health Cost Measurement in Urban Drinking Water and Sanitation: A Case Study of Lucknow City

POST DOCTORAL RESEARCH

THESIS

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PREFACE

Human health depends on safe and sufficient amount of water, adequate sanitation and hygienic conditions. Provision of adequate water supply and sanitation is a daunting task for developing countries like India due to rapid increase in urban population. This increase is further accompanied by the increase in number of slums which adversely affects the quality of life of people especially slum dwellers.

The present study has made an attempt to identify and evaluate inequities in access to drinking water and sanitation facility between slum and non-slum areas in Lucknow city, Uttar Pradesh. It has used both primary and secondary data to analyse various objectives. The study clearly brings out the fact that the residents of Lucknow especially slum dwellers are bearing huge costs to cope up with the inadequacies of water supply services which are currently being provided.

The study also measures multidimensional poverty of the slum dwellers. It has also made an attempt to present health status and to measure health cost of slum and non-slum households and found that non-slum households report the lowest for all types of illness, however, scenario in notified and non-notified slums is more or less the same. Water borne diseases are more prevalent in the study area and slum dwellers are mostly suffered. The study also focuses on measuring the factors affecting drinking water in premises, improved sanitation facility and basic hygiene sanitation facility.

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Lucknow **Dr. Rashmi Shukla**

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CHAPTER - 1

Introduction

1.0 Introduction

Drinking water is the most important basic need of human beings. Access to safe drinking water is a condition for a healthy society and a prerequisite for human development. Drinking water and sanitation are complementary to each other. Without proper sanitation, the incidence of diarrhoeal diseases due to contaminated drinking water will not come down, and without adequate water supply, improved sanitation is generally not possible. Health benefits of improved water supply and sanitation also include an increased economic wellbeing at the household level, mainly through saving large amounts of people's time and energy. Such saved time and energy can be used in economically productive or educational activities (Mavalankar, & Shankar, 2004).

1.1 Water and Sanitation as a Commodity: Conceptual Framework

The health of people is directly linked to the availability of safe water (World Water Assessment Program, 2012). A great water supply and sewerage system could enhance a nation's prestige, as modernity was increasingly associated with cleanliness and hygiene, as well as grand engineering schemes (Bryer, 2006). It may be difficult to decide how to categorise and analyse water and sanitation as specific types of goods. Water is a fluid resource with multifaceted dimensions. It is not a classic commodity (like food). It can be perceived as a free, social, economic, cultural or symbolic resource.

There are four types of goods on the basis of exclusion and rivalry, viz., private goods, public goods, club goods and common-pool resources (CPR) (Ostrom et al., 1994). A good is excludable if it is feasible and practical to selectively allow consumers to consume the good (Kolstad, 2000). Without excludability, a price system cannot work. A good is rival in consumption if its consumption reduces the amount of the good that might be available for other consumers. Private goods can be made excludable and exclusive in consumption. Consumption of a private good by a person or group diminishes its availability for others and one person or group can exclude others from consuming it while no individuals can be excluded from the enjoyment of a public good, i.e., National Defence whether they pay for it or not. Club goods are goods which can be excludable like private goods and which have non-rival consumption in nature, i.e., highways. Common-pool resources are natural or man-made resources, where exclusion is difficult and yield is subtractable (Ostrom & Gardner, 1993).

Conventionally, water is considered as a free gift of nature. But it costs to harvest, store and deliver, where and when it is needed and that sense it is not a free good but a scarce economic good (Singh & Shishodia, 2007). Water is not a normal economic good. It has a large number of characteristics that distinguishes it from other goods. Individually, these characteristics may not be unique, but their combination makes water a special economic good (Savenije, 2002). It is clear that drinking water and sanitation is neither pure private goods nor pure public goods. Water has the characteristics of impure public good, or a common pool resource that is non-excludable yet rival in consumption (Mehta, 2006). Therefore, a mixture of private good and public good properties exists in water supply (Anand, 2007). These attributes change also according to time and space through natural processes and human interference. For instance, the facilities for accessing a common-pool resource, such as an aquifer or a river, may be in private ownership, such as a private bore-well or pumping station, but the common-pool resource itself is still public. Water is best seen as an impure public good with local, national, or regional benefits and costs. Moreover, access to water is mediated by power relations, it is highly unequal (Mehta, 2003).

1.1.2 Water and Sanitation as a Merit Good

Merit goods are those goods and services where the social benefits exceed the private benefits. Any system of supplying clean potable water and sanitation to multiple households represents a merit good because there are significant benefits for the general public from each additional household's access (Noll, 2002). For instance, a household with access to clean drinking water and sanitary facilities is less likely to contact and spread water-borne diseases. The greater the spread of water and sanitation, the greater are its benefits. So, the piped water is a merit good because everybody should have access to it regardless of his ability to pay the market price.

1.2 Drinking Water and Sanitation as a Human Right

It is often argued that water and sanitation are not just basic needs but fundamental human rights based on the criteria established in international declarations that protect the right to livelihood and well-being. It is a multifaceted resource with very different attributes when compared with food (Mehta, 2006).

In July 2010, the United Nations (UN) General Assembly passed a resolution affirming water and sanitation as fundamental human rights (United Nations, 2019). “The human right to water”, declares the United Nations Committee on Economic, Social and Cultural Rights, “entitles everyone to sufficient, safe, acceptable, physically accessible and affordable water for personal and domestic use.” These five core attributes represent the foundations for water security. They also represent the benchmarks for a human right that is widely and systematically violated for a large section of humanity (UNDP, 2006). Access to water is not just a fundamental human right and an intrinsically important indicator for human progress. It also gives substance to other human rights and is a condition for attaining wider human development goals (UNDP, 2006).

1.2.1 Legal Framework in India

It is universally accepted as a fundamental right. The Indian Constitution does not specifically include a fundamental human right to water. Yet, a number of judicial pronouncements have made it clear that the right exists in India. Drinking water is acknowledged as the primary concern in the water sector. Indeed, there is no framework or drinking water law to complement the recognition of the fundamental right to water (Cullet, 2011).

Water is a state subject. But there are certain issues that are supposed to be governed or guided by national interests. The National Water Policy (NWP) represents the overall policy direction for the water sector that shall be followed at the national as well as the state levels (Warghade & Wagle, 2011). Another aspect of the 74th Amendment to the Constitution of India is that while establishment of the ULBs is mandatory, the exact scope and extent of powers to be devolved to the ULBs is left to the discretion of the state governments. However, as the 74th Amendment was enacted with a clear view to strengthening local self-governance in cities and towns, any weakening of the jurisdiction or control of the ULBs in terms of vesting of their functions to outside bodies can be seen as violation of the letter and spirit of the Constitution. The minimum core obligation of the state flowing from the right to water of every person has not yet been defined and specified in India either by the legislature or by the courts. It is felt that the time to do that is here and now (Upadhyay, 2011).

The National Water Policy has assigned highest priority to drinking water supply followed by irrigation, hydropower, navigation, industrial and other uses. According to the

Constitution of India, water supply is a state subject. The Union Government is only responsible for setting water quality standards (Srikanth, 2009).

1.3 Objectives

- To identify and evaluate inequities in access to drinking water and sanitation facility between slum and non-slum areas.
- To assess consumer coping strategies and associated costs.
- To measure multidimensional poverty especially in slum areas.
- To measure the cost of health hazard due to unsafe drinking water as well as livelihood pattern.

1.4 Research Questions

1. Is the present condition of drinking water supply of study area satisfactory and up to the mark?

2. What are the differences in access to drinking water and sanitation facility between slum and non-slum areas and what are the main reasons of these inequalities?

3. Is multidimensional poverty is prevalent especially in slum areas and what are the determining factors of multidimensional poverty?

4. Are sampled households spending a significant amount on coping strategies?

5. Are water-borne diseases due to quality of water, drinking water source, water handling practices, inadequate sanitation facility etc. or some other factors are also important?

1.5 Methodology of the Study

The study is based on mixed methodology, comprising a review of secondary data and the analysis of primary data to address the above mentioned objectives. The design of methods is as follows.

1.5.1 Data Sources

Both secondary and primary level data has been used. However, this study has been based mainly on detailed primary data collected and compiled through survey data from households.

Secondary Data: Different secondary data published from different sources, i.e. various Ministries of Government Departments, Lucknow Municipal Corporation, Jal Nigam, NSSO & Census are used. Various reports such as Uttar Pradesh Human Development Report, Uttar Pradesh Development Report, India Assessment Report, Report of Central Ground Water Board, World Water Development Report, Progress on Sanitation and Drinking Water are used for this study. Other necessary literatures for the study are also obtained from journals, books, electronic data sources and online resources apart from the collection of data from various reports,.

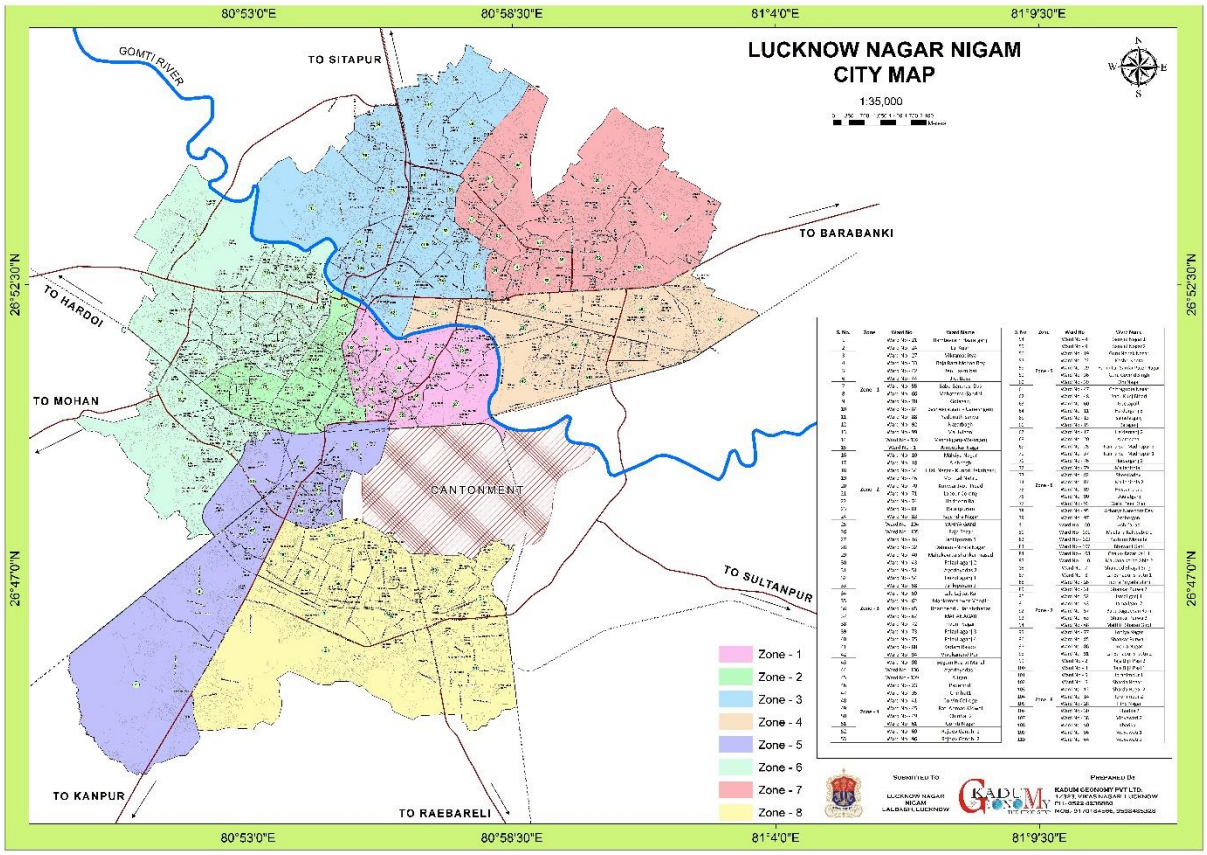
Primary Data: Primary data has been collected from Lucknow district through field survey in this study.

1.5.2 Study Area

Lucknow: Lucknow is the capital of Uttar Pradesh. The district is surrounded on the eastern side by district Barabanki, on the western side by district Unnao, on the southern side by Raebareli and on the northern side by Sitapur and Hardoi districts. It is known for its rich culture and known as 'City of Nwawbs'. Lucknow is a city of national importance owning to its historical and political significance.

Lucknow being capital city of the most populated state of India is facing tremendous population pressure. So, the number of slums is also growing. As per Rajiv Avas Yojna (RAY) report, Lucknow city has total of 609 slums out of which 502 are notified and 107 are non-notified. 67 percent slums are located in the core city area whereas 33 percent slums are located in fringe area. Total population in slum area is 7,72,807 which is about 26 percent of the total city population as per Census 2011 provisional population data (SENES Consultants, 2015). In Lucknow city, there are eight zones comprising of 110 wards (Figure 1.1). This study is performed in selected ward of each zone.

Figure 1.1: Lucknow Nagar Nigam City Map



1.5.3 Sampling Method and Size

Multistage sampling technique has been used for selection of samples in the study area. The present study covers the sample survey of 240 households. There are 110 wards classified in eight zones in Lucknow. 30 samples have been selected from each zone for the study across all eight zones; 10 households from non-slum area, 10 households from notified slum and 10 households from non-notified slum. Random sampling method has been used for selection of households. In the present study, household is considered as the unit of analysis. The survey has been conducted during April 2019 to June 2019.

1.5.4 Method of Estimation: Cost of illness method (COI) is used to measure health cost of society due to inadequate water supply and sanitation facility.

Cost of Illness Method: Cost-of-illness method is the first economic evaluation technique used in the health field. It measures the economic burden of a disease or diseases and estimates the maximum amount that could potentially be saved or gained if a disease were to be eradicated (Tarricone, 2006). It is easier to value environmental effects using cost of illness

method when the illness is relatively short, discrete and does not have negative long term impacts. COI studies generally examine direct and indirect costs. Direct costs refer to healthcare and non-healthcare costs. These costs are borne by the healthcare system, community and family in directly addressing the problem. Indirect costs are mainly productivity losses to the national economy caused by the problem or diseases, borne by the individual, family, society, or by the employer.

There are two approaches of this method, viz., prevalence based approach and incidence based approach. Prevalence based studies refer to the total number of cases in a determined period of time. This approach measures disease-attributable costs that occur concurrently with prevalent cases over a specified time period, usually a year (Larg & Moss, 2011). The incidence approach involves estimating the lifetime costs of the new cases of a condition or group or group of conditions which have their onset in a given period (Tarricone, 2006). Prevalence based Cost of Illness method has been used in this study because it is the most suitable method for assessing the total current economic burden of a health problem (Larg & Moss, 2011).

1.5.5 Analytical Tools: Various statistical techniques such as Descriptive Statistics, binomial logistic regression have been used for the analysis. The multidimensional poverty index (MPI) is estimated by counting approach developed by Alkire and Foster. The detailed methodology of constructing MPI index has been further discussed in the chapter.

Herfindhal Index: The Herfindahl index (H), also known as Herfindahl-Hirschman Index (HHI). It's value is always smaller than one. A decrease in the Herfindahl index indicates a loss of pricing power and an increase in competition, while an increase implies monopoly. The Herfindahl index can be used in the diversification measurement issues (Mishra, 2009).

Logit Model: Binary logistic model is one of the simplest qualitative response regression

models in which the regressand is of the yes/no or presence/absence type (Gujarati, et al., 2012). The probability function that underlies the logit model is the logistic distribution. The model is based on the cumulative logistic probability function and is specified as:

$$P = F(Z) = \frac{1}{(1 + e^{-(\alpha + \beta X)})}$$

Where *Z* determines a set of explanatory variables, *X; F(Z)* is the cumulative logistic function; *e* represents the base of natural logarithms and *P* is the probability of success when explanatory variable has the value *X*.

1.6 Organization of the Study

The chapter I deals with seven sections. The first section deals with the introduction, whereas second section discusses about water and sanitation as a commodity. Third section deals with drinking water and sanitation as a human right. Section four and five specify the objectives and research questions while section six explains about the methodology and section seven deals with the organization of the study.

Chapter II entitled "Socio-Economic Aspects of Study Area" consists five sections. First section deals with the introduction while second section deals with meaning and salient features of slum households in Uttar Pradesh and India. Third section covers the demographic profile of Lucknow. Fourth section introduces the study area covering demographic profile, housing characteristics, educational status, occupation, income and household possessions whereas fifth section deals with summary and conclusion.

Chapter III based on primary data entitled "Multidimensional Poverty of Slums in Lucknow" deals with six sections. The first two sections deals with introduction of multidimensional poverty, whereas second section discuss the methodology of multidimensional poverty index. The third section presents various national and international studies on multidimensional poverty while fourth section deals with multidimensional poverty in India. Fifth section analyses multidimensional poverty index in study area, its decomposition and percent contribution. It also discuss inequality in MPI across slums and its determining factors while section six deals with summary and conclusion.

Chapter IV based on the secondary and primary data entitled "Status of WASH Conditions in Lucknow" deals with seven sections. The first three sections deals with introduction, drinking water and sanitation facility at global, national and regional levels. Section four presents drinking water and sanitation facility in Uttar Pradesh while section five discuss the present situation of drinking water, sanitation, hygiene and micro environment in the study area. In sixth section, binomial logit regression has been done to find out determining

factors of drinking water facility within premises, improved sanitation facility and basic hygiene facility while last section deals with summary and conclusion.

Chapter V entitled “Coping Cost: Strategies and Management” contains seven sections. Section one and two provide a brief introduction and theoretical framework about coping cost while section three deals with review of literature. Section four discuss the frequency, pressure, adequacy and water quality of different water sources in the study area, whereas section five deals with different types of coping strategies and estimation of coping cost. Section six discuss determining factors of coping cost while section seven deals with summary and conclusion.

Chapter VI entitled “Valuation of Health Cost in Lucknow” contains seven sections. Section one and two deal with introduction and review of literature. Section three presents health status of study area while section four deals with availability of different types of healthcare services for slum and non-slum households. Section five deals with estimation of health cost and affordability of healthcare services. Section six deals with determinants of illness while section seven provides summary and conclusion.

Chapter VII of the study “Summary and Conclusion” finally makes some concluding remarks and policy implications which may be useful for the implementation of water supply and sanitation projects in urban areas.

CHAPTER – 2

Socio-Economic Aspects of Study Area

2.0 Introduction

In the 21st century, cities are the platforms for global and local change. They have emerged as the world's economic platforms for production, innovation and trade over the last two decades. The world is becoming increasingly urbanized. The world's urban population has increased from 45 percent in 1995 to 55 percent in 2018 and by 2030, 60 percent of the world population is projected to be urban (UN-HABITAT, 2016 & United Nations, 2018). In 2000, there were 371 cities with 1 million inhabitants or more worldwide and by 2030, 706 cities are projected to have at least one million residents. At present, 23 percent of world population (1.7 billion) live in a city with at least 1 million inhabitants. The number of megacities[1] is projected to be 43 in 2030 (United Nations, 2018). Asia has the highest number of people living in urban areas, followed by Europe, Africa and Latin America. The rate of increase in urban population in low income countries is much higher compared to middle and high income countries during 1995 to 2015. Of the world's 33 megacities, 27 are located in the less developed regions (United Nations, 2018). The twenty-first century is witnessing sustained population growth together with urbanization and industrialization. Although urbanization has the potential to make cities more prosperous, but it generates multiple forms of inequality, exclusion and deprivation, which creates spatial inequalities and divided cities into gated communities and slums.

India's urban population is also increasing. It has steadily increased from 23.3 percent in 1981 to 31.16 percent in 2011 and likely to double to reach 600 million by 2030 (GOI, 2013). This increase has also been accompanied by rapid growth of slums in cities. By 2030, the population of Delhi is projected to increase by more than 10 million inhabitants and it will overtake Tokyo as the world's largest cities (United Nations, 2018). Urban expansion has placed cities of India in a challenging situation with limited infrastructure facilities which adversely affect the quality of life of people especially slum dwellers.

2.1 Slum: Meaning & Definition

Slums are the emerging human settlements of the 21st century. The word 'Slum' is first appeared in 19th century in London when the urban working classes moved into overcrowded and poorly serviced tenements. The term was initially referred to 'a room of low repute', but over a time, squalid and overcrowded urban area inhabited by very poor people is called a slum

[1] Cities with more than 10 million inhabitants are termed as 'megacities'.

(UN-HABITAT, 2006). United Nations defined slum as "a contiguous settlement where the inhabitants are characterized as having inadequate housing and basic services." (GOI, 2013).

The slum challenge continues to be one of the faces of poverty in cities in developing countries. However, the proportion of slum dwellers in urban areas across all developing regions has reduced since 1990, but the absolute number of slum dwellers has increased gradually. More than 70 percent of Africa's urban population lives in slums. In developing countries, slum population has increased from 689 million in 1990 to 881 million in 2014 (UN-HABITAT, 2016). The growing number of slum dwellers is the result of both urbanization and population growth that are outpacing the construction of new affordable homes. Urbanization is closely associated with development; slum dwellers will be left behind in this process. Slums are the products of failed policies, poor governance, corruption, inappropriate regulation, dysfunctional land markets, unresponsive financial systems, and a lack of political will (UN-HABITAT, 2016).

2.1.1 Slums in India

Slum is a heavily populated urban informal settlement characterized by substandard housing and squalor. There are regional differences in the names by which slums are known in India, i.e., 'Jhuggi – Jhompdi' in Delhi, 'Jhopadpatti or Chawls' in Mumbai, 'Ahatas' in Kanpur, 'Bustees' in Kolkata, 'Cheris' in Chennai and 'Keris' in Bangalore. But physical characteristics in most of these slums are essentially the same. Slum is a heavily populated urban informal settlement characterized by substandard housing and squalor. Slums are often the only type of settlement that is affordable and accessible to the poor in cities, where competition for land and profit is intense (Basappa, 2015). In India, migration has played an important role in accelerated urban growth. Rural migrants are attracted to urban areas for economic reasons regardless of the fact that physical infrastructure in terms of housing, drinking water supply, drainage, sanitation etc. is not so adequate in the cities. The problem of slums is now a common feature of almost all major Indian cities (GOI, 2010).

Slum Area Improvement and Clearance Act, 1956 defines slums as mainly those residential areas where dwellings are in any respect unfit for human habitation by reasons of dilapidation, overcrowding, faulty arrangements and designs of such buildings, narrowness or faulty arrangement of streets, lack of ventilation, light, sanitation facilities or any combination

of these factors which are detrimental to safety, health and morals (GOI, 2013a). According to Census, slums are classified into three types; notified, recognized and identified[2] (GOI, 2010). As per National Sample Survey Organization (NSSO), "A slum is a compact settlement of at least 20 households with a collection of poorly built tenements, mostly of temporary nature, crowded together with usually inadequate sanitary and drinking water facilities in unhygienic conditions" (GOI, 2013a). According to NSSO, slums are classified as notified slums and non-notified slums. **Notified slums** are areas notified as slums by the concerned State governments, municipalities, corporations, local bodies or development authorities while any compact settlement with a collection of poorly built tenements, mostly of temporary nature, crowded together, usually with inadequate sanitary and drinking water facilities in unhygienic conditions is not notified as a slum by the concerned State governments, it will be called **non-notified slum** (GOI, 2003). A non-notified slum must consist of at least 20 households, no such restriction is imposed in case of notified slums.

2.1.2 Salient Features of Slum Households in Uttar Pradesh and India

India's urban population is increasing at a faster rate than its total population due to natural increase, migration and reclassification of villages into cities and towns. Due to rising population, the number of slum dwellers is increasing in Indian cities. While slums differ in size and other characteristics across states, most lack reliable sanitation services, supply of clean water, reliable electricity, timely law enforcement and other basic services. Uttar Pradesh is the most populous state of India with a total population of 19.96 crore. Out of 4041 statutory towns of India 648 exist in Uttar Pradesh. There are 33 urban agglomerations[3] (UA) in India while 7 UA in Uttar Pradesh. Percentage of urban population to total population of the State stands at 22.28 in 2011 whereas, this percentage was 20.78 in 2001. However, the level of urbanization in the State is lower than most of its neighbours and the national average (31.16 percent).

[2] **Notified slums** are areas in a town or city notified as 'Slum' by State, UT Administration or Local Government under any Act including a 'Slum Act'. **Recognized slums** are 'Slum' by State, UT Administration or Local Government, Housing and Slum Boards, which may have not been formally notified as slum under any act while **identified slums** refer to a compact area of at least 300 population or about 60-70 households of poorly built congested tenements, in unhygienic environment usually with inadequate infrastructure and lacking in proper sanitary and drinking water facilities (GOI, 2013a).

[3] Cities having population 1 million or above are called urban agglomerations (Census, 2011).

For the first time, the Census of India 2011 has presented separate estimates of the population in slums. As per census 2011, there are 137.5 million slum households in India. Out of which about 38 percent households live in 46 million plus cities. Greater Visakhapatnam has the highest percentage of slum households, i.e., 44.1 percent of total urban households (GOI, 2013). Out of 4041 statutory towns, 2543 towns reported slums in India while in Uttar Pradesh, 260 towns reported slums out of 648 statutory towns (Table 2.1). As a percentage of total urban households, Uttar Pradesh has a lower proportion of slum households (13.3 percent) as compared to all India average (17.43 percent).

Table 2.1: Slum Households Profile of Uttar Pradesh & India in 2011

Indicator	India		Uttar Pradesh	
	Urban	Slum	Urban	Slum
Statutory Towns	4041	2543	648	260
Number of Households	788.7 lakh	137.5 lakh	74.4 lakh	9.9 lakh
Population	3771.1 lakh	654.9 lakh	444.9 lakh	62.4 lakh

Source: Census of India 2011: Tables on Housing Stock, Amenities and Assets in Slums.

Adequate housing is a human right, and the absence of it negatively affects urban equity and inclusion, health and safety, and livelihood opportunities. Census has distributed the households into three main groups according to the structure of house occupied, i.e., households occupying pucca houses (permanent), households occupying semi-pucca houses (semi-permanent) and households occupying kutcha houses (temporary). Habitable condition of Indian slum households is better than slum households of Uttar Pradesh while slum households of Uttar Pradesh is in better condition than Indian slum households in terms of type of structure (Table 2.2). Among Indian slum households, 58 percent households are in 'good habitable condition' while 38 percent households are in 'liveable habitable condition'. However, the percentages are 49 and 45 for Uttar Pradesh respectively.

Table 2.2: Distribution of Urban & Slum Households of Uttar Pradesh & India by Some Housing Characteristics (in Percent)

Household Characteristics	India		Uttar Pradesh	
	Urban	Slum	Urban	Slum
Habitable Condition				
Good	68.5	58.44	57.09	49.5
Livable	28.6	37.52	38.93	45.47
Dilapidated	2.9	4.03	3.98	5
Type of Structure				
Permanent	84.28	77.73	84.29	82.2
Semi-permanent	11.61	16.05	8.55	9.42
Temporary	3.18	5.25	4.36	5.92

Source: Census of India 2011: Tables on Housing Stock, Amenities and Assets in Slums.

Slums are characterized by acute over-crowding, insanitary, unhealthy and dehumanizing living conditions. They are subject to insecure land tenure, lack of access to basic minimum civic services such as safe drinking water, sanitation, solid waste management, internal and approach roads etc. It is clearly evident that living conditions of slum households are worse than urban households (Table 2.3). In terms of location of drinking water source, slum households of Uttar Pradesh are in better condition as compared to national average. 66 percent Indian slum households and 77 percent slum households of Uttar Pradesh have latrine facility in their homes while about 18 percent households use open space for latrine purpose. Out of 137.5 lakh slum households in the country, 53 percent slum households availed banking service facilities in 2011 while 56 percent slum households avail banking services in Uttar Pradesh.

Table 2.3: Distribution of Urban & Slum Households by Some Basic Amenities and Services (in Percent)

Amenities & Services	India		Uttar Pradesh	
	Urban	Slum	Urban	Slum
Location of Drinking Water				
Within Premises	71.72	56.72	78.81	71
Near Premises	20.74	31.89	15.96	21.75
Away	8.05	11.39	5.22	7.24
Sanitation Facility				
Latrine Within Premises	81.4	66	83.1	77.48
Piped Sewer System	32.7	24.51	28.3	20.53
Public Latrine	6	15.09	2.1	3.76
Open Defecation	12.6	18.9	14.8	18.76
Wastewater connected to				
Closed Drainage	44.5	36.95	32.18	21.52
Open Drainage	37.3	44.29	61.18	70.74
No Drainage	18.2	18.76	6.63	7.74
Has Kitchen	77.8	65.29	66.88	57.39
LPG/PNG	65	51.26	61.7	54.22
Has Bathroom	77.5	66.57	69.72	61.42
Electricity	92.7	90.54	81.42	77.99
Availing Banking Services	67.8	53.18	66.7	56.07

Source: Census of India 2011: Tables on Housing Stock, Amenities and Assets in Slums.

2.2 Lucknow City

Lucknow, being the state capital, is a prominent administrative and commercial centre of the state. It is known for its culture and history. It is one of the most populous cities of Uttar Pradesh and ranks 5th in terms of total population of the state as Prayagraj ranks 1st, Moradabad ranks 2nd, Ghaziabad ranks 3rd and Azamgarh ranks 4th in terms of total population of the state. Lucknow is surrounded on the eastern side by district Barabanki, on the western side by district Unnao, on the southern side by Raebareli and on the northern side by Sitapur and Hardoi districts.

2.2.1 Demographic Profile of Lucknow

The baseline demographic and socio-economic characteristics with regards to demography, literacy and occupational status of Lucknow city (Nagar Nigam), Lucknow district and Uttar Pradesh have been described based on the data obtained from Census of India, 2011 (Table 2.4). The demographic structure of Lucknow city is different from the district and state level. The total population of Lucknow city (Nagar Nigam) is 28,17,105 out of which male and female are 14,60,970 and 13,56,135 respectively. The proportion of male and female shows the dominance of male out of total population. In Lucknow city, sex ratio, density and decennial growth are much higher than the district and state average mainly due to the extension of the jurisdiction of the Lucknow Municipal Corporation. The decadal population growth rate in 2001-11 is 28.87 percent. The population of children below 6 years as on 2011 in Lucknow is 2,93,697 which constitutes about 10.43 percent of total population. However, child sex ratio of Lucknow district is higher than Lucknow city as it is 913 in Lucknow district as compared to 904 in Lucknow city.

Literacy is one of the important social indicators to measure the development of its inhabitants. Literacy rate of Uttar Pradesh is 67.7 percent. But Uttar Pradesh has literacy rate below the national average in respect of all three categories i.e., persons, males and females. The literacy rate of Lucknow city in 2011 is 82.5 percent with male and female literacy rate being 86.04 percent and 78.7 percent respectively (GOI, 2011). As per census 2011, the workforce participation rate of Uttar Pradesh is 32.9 percent. Work participation rate of Lucknow city and district is almost similar. Census classifies workers into two categories, i.e.,

main workers[4] and marginal workers[5]. The ratio of main workers is higher in Lucknow city. It has higher ratio of main workers and lower ratio of marginal workers as compared to district and state level.

Table 2.4: Demographic Features of Lucknow Municipal Corporation, Lucknow District and Uttar Pradesh

Parameters	Lucknow (M. Corp.)	Lucknow District	Uttar Pradesh
1. Demographic Status			
Total Population	28,17,105	45,89,838	19,98,12,341
Male	14,60,970	23,94,476	10,44,80,510
Female	13,56,135	21,80,558	9,53,31,831
Decadal Growth (in percent)	28.87	25.79	20.2
Sex Ratio (females per thousand males)	928	906	912
Density (Persons per sq. Km.)	8076.56	1815	829
Child Population (0-6 years)	2,93,697	521,815	30,791,331
Child Sex Ratio (per thousand male child)	904	913	902
2. Educational Status			
Literacy Rate (in percent)	82.5	77.3	67.7
Male Literacy Rate (in percent)	86.04	82.6	77.3
Female Literacy Rate (in percent)	78.7	71.5	57.2
3. Occupational Status			
Work Participation Rate (in percent)	33.52	33.6	32.9
Main Workers (in percent)	26.85	25.1	22.3
Marginal Workers (in percent)	6.67	8.5	10.6
Non Workers (in percent)	66.48	66.4	67.1

Source: Computed from Primary Census Abstract, 2011.

2.2.2 Salient Features of Slum Households in Lucknow

Lucknow is one of the fastest growing cities. Lucknow has witnessed substantial urban expansion over the last few decades, i.e., 4.6 lakhs in 1951 to 28 lakhs in 2011. Lucknow

[4] Main workers are those workers who had worked in some economic activity for the major part of the year, i.e., for a period of six months (183 days) or more (Government of Uttar Pradesh, 2006, p.112).

[5] Marginal workers are those workers who had worked for some time during the last year, but not for the major part, i.e., less than 183 days (Government of Uttar Pradesh, 2006, p.112).

attracts large number of migrants with its fast growing economy. Like other Indian metropolitan cities, increased urbanization has posed serious challenges in providing infrastructural facilities. The city has 609 slums with 1,48,117 households. Out of the total slums 502 are notified slums and the remaining 107 are non-notified. As per census 2011, total population in slum areas is 7,72,807 which constitute about 27 percent of city population.

The living conditions in slums represent the worst of urban poverty. Slum dwellers have to face serious challenges in their efforts to survive. Based on Rajiv Awas Yojana Report 2012, 77 percent of the total slum population belongs to OBC and SC community and 69 percent slum population of Lucknow lives below poverty line (BPL). Out of 609 slums, 353 were built on land belongs to private ownership and 115 slums were situated on land belongs to state government. 67 percent of the slum settlements are situated around the core area of the city. The total number of dwelling units in the slums are 1,12,089 in Lucknow city. Out of which, 65 percent units are pucca, 27 percent units are semi-pucca and 8 percent units are kutcha in nature (GoUP, 2012).

2.3 Socio-Economic Profile of the Study Area

2.3.1 Demographic Profile

Lucknow city is divided into eight zones and 110 municipal wards for the administrative purpose. The study covers a population of 1178 in the two hundred forty households surveyed in eight zones of Lucknow. These data have been collected by conducting a survey in the study area during May 2019 to June 2019. Within the study population, more than 68 percent of households are nuclear families. The average number of members per household in the study area is 4.92 with a range of 2 to 13 persons per family. The household size of non-notified slum dwellers is largest among all types of households (Table 2.5).

All sampled households belong to three castes; General, Other Backward Class (OBC) and Scheduled Caste (SC) and there is no observation of Schedule Tribes (ST) in the study area. Out of 240 households, caste wise classification shows that general category is the dominant group consists of 63 percent in non-slum households while relatively large proportion of socio-culturally disadvantaged communities are living in slums. The most of the slum households whether they live in notified slums or non-notified slums, belongs to the OBC followed by SC. Half households of notified slums and about 56 percent households of non-

notified slums belong to OBC while the proportion of SC population is same in both type of households (Table 5). Across the slums, 90 percent slum households of Majharuislam Madarsa belong to OBC while Dubbaga, Baba Purwa and Luvkush Nagar are some slums where the proportion of Scheduled caste people is highest. As per Rajiv Awas Yojana, 77 percent slum population belongs to OBC and SC division of social groups (GoUP, 2012). Moreover, Hindu is the dominant religion group constitutes 79 percent of the total households, whereas Muslims constitute nearly 21 percent of the total households in the study area.

Table 2.5: Demographic Characteristics of Sampled Households

Household's Characteristics	Non-slum Households	Notified Slum Households	Non-notified Slum Households	Total Sampled Households
No. of Households	80	80	80	240
Total Population	385	395	398	1178
Family size (Mean & SD)				
Family size (Mean)	4.81	4.96	4.98	4.92
Family size (SD)	1.75	1.78	2.03	1.85
Caste				
General Caste (in percent)	63.75	18.75	13.75	32.08
OBC (in percent)	21.25	50	56.25	42.5
SC (in percent)	15	31.25	30	25.42

Source: Primary Data.

2.3.2 Housing Characteristics

Housing is one of the prime indicators to assess the existing condition of a slum. There are three types of houses such as kutcha[6], semi-pucca[7] and pucca house[8] in the study area. About 43 percent sampled households live in pucca house while one-third households live in semi-pucca and one-fourth households live in kutcha house. Housing status by type of households reveals that majority of non-slum households live in pucca house. 32 percent households of notified slums and only 1 percent households of non-notified slums live in pucca house and the rest in semi-pucca or kutcha houses.

A wide disparity can be seen in housing status among various notified and non-notified slums (Table 2.6). More than half households of notified slums live in semi-pucca house. Out

[6] Houses made from mud, thatch, or other low-quality materials are called kachha houses.

[7] Houses that use partly low-quality and partly high-quality materials are called semi-pucca houses.

[8] Houses made with high quality materials throughout, including the floor, roof, and exterior walls, are called pucca houses (IIPS, 2007, p.37).

of which 90 percent households of Behasa and Bhikumpur live in semi-pucca house while in Dubbaga, Chota Burha and Buroolia, half of the households live in pucca house. About 58 percent households of non-notified slums live in kutcha house. There are few non-notified slums, i.e., Jawahar Nagar of Daliganj ward and Luvkush Nagar of Lal Bahadur Shastri ward, where all households live in kutcha houses. Correspondingly, Baba Purwa, Majharuislam Madarsa, Cheeken wali Guli, Ricksaw Calony are non-notified slums, where more than 50 percent of the households live in semi-pucca houses. This implies that there is unhealthy and unsustainable living condition for slum households and it is more miserable for non-notified slums.

Table 2.6: Slum-wise Type of Houses in Lucknow (in Percent)

Zone	Slum Name	Pucca House	Semi-pucca House	Kachha House
Notified Slums		**32.5**	**55**	**12.5**
1	Shahnazaf Imambara	10	40	50
2	Sudarshan Puri	40	60	00
3	Buroolia	60	20	20
4	Bhikhumpur	10	90	00
5	Chota Burha	50	30	20
6	Dubbaga	50	50	00
7	Luvkush Nagar	40	60	00
8	Behasa	00	90	10
Non-Notified Slums		**1.25**	**41.25**	**57.5**
1	Baluadda	00	50	50
2	Majharuislam Madarsa	00	60	40
3	Jawahar Nagar	00	00	100
4	Baba Purwa	00	80	20
5	Amausi	00	20	80
6	Cheeken wali Guli	10	60	30
7	Luvkush Nagar	00	00	100
8	Ricksaw Calony	00	60	40

Source: Primary Data.

2.3.3 Educational Status

Literacy rate[9] is an important social indicator to measure the development of its inhabitants. The study covers a population of 1178 in the surveyed two hundred forty households. About 10 percent population come under the age group of 0 to 7 years. As per Census definition, 68 percent population out of 1064 persons is literate in the study area and 32 percent of the sampled population continues to have no education (Table 2.7). Among different types of households, non-notified slums have highest percentage of illiterates, i.e., 65 percent while non-slum households have 100 percent literates. Literacy rate of notified slums is 68 percent. As per Rajiv Awas Yojana, the literacy rate of slums in Lucknow is 62 percent (GoUP, 2012).

Table 2.7: Literacy Level of Study Area

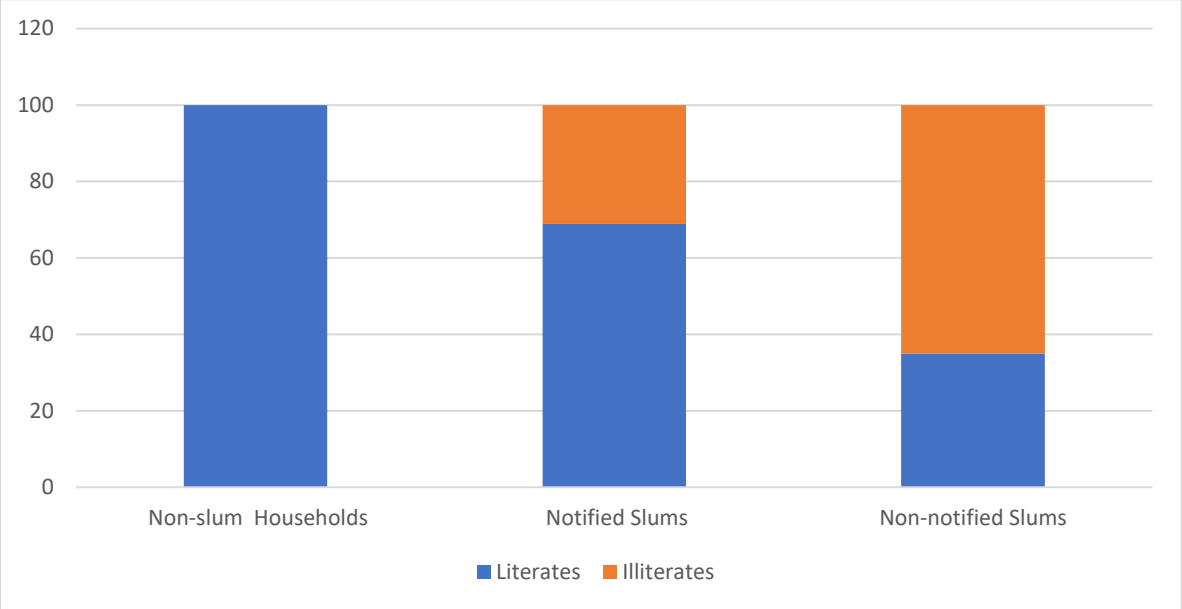
Parameter	No.	Percentage
Population	1178	100
Population (0-7 years)	114	9.68
Population (above 7 years)	1064	90.32
Literates	**723**	**67.95**
Non-slum Households	352	100
Notified Slums	248	68.89
Non-notified Slums	123	34.94
Illiterates	**341**	**32.05**
Non-slum Households	00	00
Notified Slums	112	31.11
Non-notified Slums	229	65.06

Source: Primary Data.

Figure 2.1 shows the differences of literacy rate among different types of households. Literacy is least among men and women who live in non-notified slums, whereas literacy is somewhat higher among women and men of notified slums.

[9] A person aged seven and above who can both read and write with understanding in any language, is treated as literate. A person who can only read but cannot write, is not literate (GOI, 2011d, p.27).

Figure 2.1: Literacy Rate in Different Types of Households in Lucknow (in Percent)



Source: Primary Data.

There is the existence of large disparities in educational achievements among different types of households (Table 2.8). Among the non-slum households, more than half inhabitants have completed their degrees of graduation and post-graduation while only 4 percent inhabitants of notified slums and 1.76 percent inhabitants of non-notified slums have obtained their graduation degree. None of the notified and non-notified slum dweller has post-graduation degree**.** On the other hand, 34 percent inhabitants of notified slums and 21 percent inhabitants of non-notified slums have education up to primary and upper primary. These figures are indicative of the poor level of education in both notified and non-notified slums. Lower literacy and educational attainments result in lower earning capacity (Kurian, 2007).

Table 2.8: Household-wise Education Level of Study Area (in Percent)

Education Level	Non-slum Households	Notified Slum Households	Non-notified Slum Households	Total Sampled Households
Primary	9.61	17.97	14.32	14.01
Junior	8.05	16.96	7.29	10.78
Intermediate	22.08	23.8	7.54	17.74
Graduate	35.06	4.05	1.76	13.41
Post-Graduate	19.48	00	00	1.76

Source: Primary Data.

There is considerable variation in education level among slums (Table 2.9). Among the notified slums, Bhikhumpur, Shahnazaf Imambara, Luvkush Nagar and Dubbaga have the highest percentage of illiterates (46.34, 40.43, 36.84 and 34.69 respectively). On the other hand, Chota Burha and Behasa have less than 20 percent illiterates. It is observed that all slum dwellers of Jawahar Nagar, a non-notified slum of zone 3 are illiterates. While Majharuislam Madarsa, Amausi, Cheeken wali guli and Luvkush Nagar have more than 70 percent illiterates. No one has education above intermediate level in one notified slum and five non-notified slums out of 16 slums. Education serves as a tool of social change. There is a strong correlation between level of literacy and poverty. Level of literacy determines earning level, activity pattern and standard of living in the globalized India today (GoUP, 2006). Lack of higher education adversely affects better jobs or regular jobs from the labour market.

Table 2.9: Slum-wise Education Level of Study Area (in Percent)

Slum Name	Illiterate	Primary	Junior	Intermediate	Graduate and above
Shahnazaf Imambara	40.43	19.19	10.64	21.28	8.51
Sudarshan Puri	27.91	13.95	27.91	27.91	2.33
Buroolia	35	21.67	16.67	18.33	5
Bhikhumpur	46.34	19.51	21.95	12.2	00
Chota Burha	17.65	26.53	26.53	29.41	5.88
Dubbaga	34.69	12.24	14.29	32.65	6.12
Luvkush Nagar	36.84	15.79	12.28	31.58	3.51
Behasa	19.05	28.57	21.43	28.57	2.38
Baluadda	69.44	13.89	13.89	2.78	00
Majharuislam Madarsa	89.39	4.55	3.03	1.52	1.52
Jawahar Nagar	100	00	00	00	00
Baba Purwa	29.82	26.32	19.3	19.3	5.26
Amausi	79.07	13.95	2.33	4.65	00
Cheeken wali Guli	72.73	12.12	6.06	9.09	00
Luvkush Nagar	70.21	21.28	4.26	4.26	00
Ricksaw Calony	21.43	33.33	14.29	23.81	7.14

Source: Primary Data.

2.3.4 Occupational Status

Work participation rate[10] in study area is greater than that of in Uttar Pradesh as a whole. The sample survey shows that about 41 percent of the population are economically active and the rest 59 percent are non-workers. The sampled population consists of various types of households, i.e., non-slum, notified and non-notified. WPR is the highest for households of notified slums and it is lowest for non-slum households (Table 2.10). This is because of the women residing in slums are found working shoulder to shoulder with men and bore the responsibility for the family. Slums have lower percentage of unemployed people as majority of slum dwellers work in unproductive and lower wage jobs. The share of working population is highest in Sudarshanpuri slum of zone 2 and Cheeken wali guli of zone 6 and lowest in Dubbaga, Amausi and Baba Purwa. Proportion of dependents is highest in non-notified slums due to age composition of the sampled population.

Table 2.10: Type of Household-wise Occupation Status of Study Area (in Percent)

Occupation Status	Non-slum Households	Notified Slum Households	Non-notified Slum Households	Total Sampled Households
Employed	37.66	43.8	41.21	40.92
Unemployed	15.32	12.41	9.55	12.39
Dependent	47.01	43.8	49.25	46.69

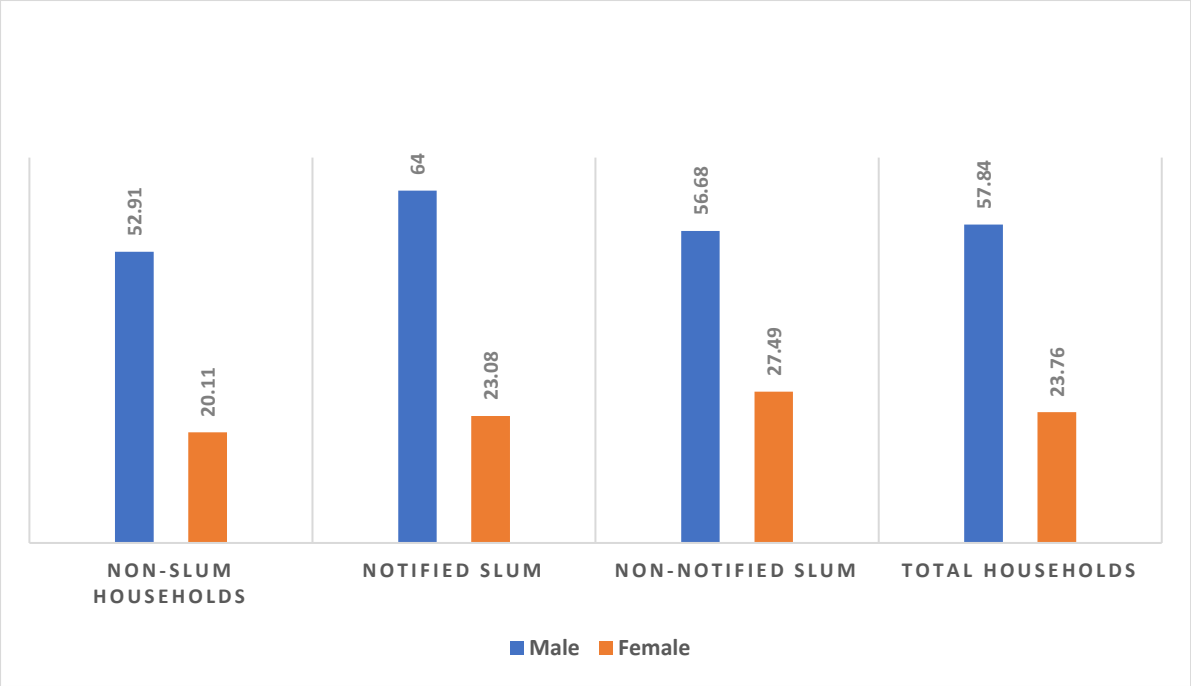
Source: Primary Data.

There are 57.84 percent males and 23.76 percent females are economically active in the study area. This indicates low female involvement in economic activity. As per 2011 census. WPR of Uttar Pradesh was very low for females at 16.7 percent as compared to 47.7 percent for males. The Global Gender Gap data for 135 countries also shows that women's economic participation and opportunity is worse in India than in 95 per cent of all other countries studied (GoI, 2013b). The female WPR varies by different types of households (Figure 2.2). It is significantly higher in slum areas as females residing in slums have to work for their families in spite of lower wage and unhygienic working conditions. On the other hand, female WPR is the lowest for non-slum households due to their better economic status. Generally, females move into the labour force during crisis or distress and withdraw when

[10] Work participation rate (WPR) is the ratio of workers to total population. It shows the proportion of population engaged in gainful economic activity.

economic conditions of the household are better. The proportion of females attending to domestic duties increases with household consumption expenditures, particularly in the urban areas (Thomas, 2012). A recent study also found that per capita income is negatively related to female WPR as their participation in the labour force depends upon various other socio-economic dynamics such as social environment dominated by patriarchy, family income, migration, etc (Tiwari & Tiwari, 2016).

Figure 2.2: Work Participation Rate of Study Area by Gender (in Percent)



Source: Primary Data.

The occupational pattern has been categorised in four categories such as self-employed, professionals & semi-professionals, salaried class / regular wage earners and casual workers. On the other hand, the category 'others' includes unemployed and dependents. About 7 percent population are self-employed. The self-employed workers are found to be engaged in various activities in the study area, i.e., non-slum residents are doing business and they have also employed some other people in their work while almost slum-dwellers have a small shop which were either home based or located outside. The second category of workers includes professionals & semi-professionals[11] and these types of workers are found only in non-slum

[11] Professional category includes doctors, advocates engineers, chartered accountants, college, university and higher education teaching professionals or such persons with professional qualification while semi-professionals

households due to their higher education as occupation is associated with the educational standard up to a large extent. The workers who received their income on the basis of monthly salary are belonged to the salaried group. Government employees, workers of private sectors, drivers, watchmen, safai kurmcharies of municipality come in this category. 20 percent of non-slum areas, 16 percent of notified slums and 6 percent population of non-notified slums are regular wage earners (Table 2.11). The workers who engaged in field such as construction, mason, sales, street vending, head load work, rickshaw driver, domestic and related helpers, dhobi, plumber, painter etc. are treated as casual labour. The share of casual labour is highest in non-notified slum households, i.e., 32 percent, whereas about 17 percent dwellers of notified slums is working as casual labour.

Across the slums, the share of self-employed is highest in Chota Burha, i.e., 23.68 percent, whereas Sudarshanpuri has the maximum people with regular salary i.e. 43 percent. Jawahar Nagar, Cheeken wali Guli and Majharuislam Madursa have the maximum number of casual labours, i.e., 40 percent, 38.89 percent and 35.71 percent respectively. Thus, a majority of the working population in the slums is engaged as casual labour. On the other hand, women residing in slums are majorly involved in domestic help while some of them do embroidery work too.

Table 2.11: Type of Household-wise Occupation Pattern of Study Area (in Percent)

Occupation Pattern	Non-slum Households	Notified Slum Households	Non-notified Slum Households	Total Sampled Households
Self Employed	8.83	9.62	3.02	7.13
Professionals & Semi-professionals	7.79	00	00	2.55
Salaried / Regular Wage	20.52	16.71	6.03	14.35
Casual Labour	0.26	17.47	32.16	16.81
Others	62.6	56.2	58.79	59.17

Source: Primary Data.

are those who are in middle and primary education teaching, lab assistant, computer assistant, dieticians, income tax inspector, legal assistant, administrative associate professionals, fashion designer, interior designer etc (GOI, 2004).

2.3.5 Income Pattern

Income is one of the most important indicators of socio-economic status. Non-slum households have the highest average monthly income while it is least for non-notified slums. The educational qualification and occupational pattern are important reasons for this as majority of non-slum households are highly educated and professional / semi-professional or salaried class. The mean monthly income of non-slum households is Rs. 62,880 while it is only Rs. 16,246.3 for notified slums and Rs. 10,776.3 is for non-notified slums (Table 2.12). About 25 percent households of non-notified slums have income below Rs. 7000 and 27 percent households have income ranging from Rs. 7,001 to 10,000. On the other hand, only 19 percent slum dwellers in notified areas earn income below Rs. 10,000. Among the different categories, the general households have the better average monthly earning than those of any other categories, i.e. OBC, SC and ST.

Table 2.12: Type of Household-wise Average Monthly Income in Lucknow

Type of Households	Mean	Standard Deviation	Minimum	Maximum
Non-slum Households	62880	37851.56	15000	200000
Notified Slums	16246.3	5306.598	6000	31000
Non-notified Slums	10776.3	3873.71	4500	23000
Total Households	29967.5	32198.48	4500	200000

Source: Primary Data.

There is quite variation in income pattern of different slums in the study area (Table 2.13). In notified slums, households in Luvkush Nagar on an average earn Rs. 20,600 monthly which is highest across the slums and households of Behasa earn the least average monthly income among notified slums, i.e., Rs. 11,550. On the other hand, households in Jawahar Nagar have the least mean monthly income (Rs. 6,550) and households in Majharuislam Madarsa have the highest mean monthly income (Rs. 14,040) among non-notified slums.

Table 2.13: Slum-wise Average Monthly Income (in Rs.)

Slum Name	Mean	Standard Deviation	Minimum	Maximum
Shahnazaf Imambara	17900	6257.44	8000	27500
Sudarshan Puri	18520	4728.32	12000	27000
Buroolia	15650	3605.94	10000	22000
Bhikhumpur	15000	5038.74	9000	24000
Chota Burha	15000	5797.51	8000	27000

Dubbaga	15750	4354.12	9000	24000
Luvkush Nagar	20600	5440.59	13000	31000
Behasa	11550	3269.81	6000	17000
Baluadda	11150	2797.72	7000	15500
Majharuislam Madarsa	14040	3724.45	9000	20000
Jawahar Nagar	6550	1770.91	4500	10500
Baba Purwa	12470	4987.55	6700	23000
Amausi	11180	3759.67	5000	17000
Cheeken wali Guli	9020	3424.36	5000	15000
Luvkush Nagar	11050	3370.21	6000	18000
Ricksaw Calony	10750	2463.62	6000	15000

Source: Primary Data.

2.4 Summary & Conclusion

Urbanization is a distinguishing phenomenon of the 21st century. Urban centers offer diverse employment opportunities and means of livelihoods that attract the poor from the countryside to the cities. Since 1990, the world has seen an increased gathering of its population in urban areas, but many cities all over the world are grossly unprepared for the multidimensional challenges associated with urbanization. Although urbanization is essential for socio-economic transformation, wealth generation, prosperity and development, but the growing urban population creates deficiencies on the limited urban infrastructure which results in growing number of slum dwellers in developing countries. India's urban population has also increased from 23 percent in 1981 to 27.8 percent in 2001 and 31 percent in 2011 respectively. This increase has also been accompanied by rapid growth of slums in cities. As per census 2011, there are 137.5 million slum households in India. Out of which about 38 percent households live in 46 million plus cities. Uttar Pradesh has a lower proportion of slum households as compared to all India average. It is clearly evident that living conditions of slum households are worse than urban households in Uttar Pradesh as well as national average.

Lucknow is one of the most populous cities of Uttar Pradesh. The demographic structure of Lucknow city is different from the district and state level. As per census 2011, the total population of Lucknow city is 28.17 lakh. The decadal population growth rate is 28.87 percent. In Lucknow city, sex ratio, density and decennial growth are much higher than the district and state average mainly due to the extension of the jurisdiction of the Lucknow Municipal Corporation.

Socio-economic profile of study area shows that every slum is different in its origin, location, size and demographic characteristics. All characteristics are not common for all surveyed slums in the city. Most of the slum households whether they live in notified slums or in non-notified slums, belongs to the OBC and SC while general category is the dominant group in non-slum households. The large scale inters and intra disparities across slum households and non-slum households are found in terms of housing status, education, occupation and income in the field survey. It is observed that more than half households of notified slums live in semi-pucca house and about 58 percent households of non-notified slums live in kutcha house. In terms of literacy attainment, 68 percent people of notified slums and 34 percent of non-notified slums are literate and majority of them have low educational qualification. There is a strong correlation between level of education and poverty. It is observed that majority of slum dwellers work in unproductive and lower wage jobs. The share of casual labour is the highest in non-notified slum households. Non-slum households are comparatively at a higher level of occupation as compared to slum households because of higher educational attainment. It may be concluded that the study area is marked by sharp economic and social inequalities among different types of households.

CHAPTER - 3

Multidimensional Poverty of Slums in Lucknow

3.0 Introduction

Poverty identifies people whose attainments place them at the bottom of the distribution. The traditional approach to measuring poverty focuses on the use of resources by the people. The most common measures of resources use so far are monetary indicators of income or consumption. Sen argues that poverty should be seen as capability deprivation rather than in the space of income or expenditure. In many approaches, resources are extended to include social primary good.

Multidimensional poverty is a new concept. Poverty has many dimensions beyond a lack of money. Poverty is essentially a multidimensional phenomenon (Bourguignon & Chakravarty, 2003). In this context, the identification of poor is more complex. According to Alkire, poverty is a condition in which people are exposed to multiple disadvantages, such as actual and potential. It consists of homelessness, landlessness, joblessness and health catastrophes as well as low income. The terms deprived and poor are not synonymous. A person who is deprived in any particular dimension may not necessarily be considered poor. Someone can be poor yet not deprived in every single indicator.

3.1 Multidimensional Poverty Index (MPI)

The Multidimensional Poverty Index (MPI) was developed in 2010 by the Oxford Poverty & Human Development Initiative (OPHI) and the United Nations Development Programme (UNDP) and used different factors to determine poverty beyond income-based lists. It replaced the previous Human Poverty Index. The index identified deprivations across the same three dimensions, i.e., health, education and standard of living as the Human Development Index (HDI). The index comprises ten indicators.

In 2014, an innovative MPI (MPI-I) was also developed. It modified five indicators, viz., nutrition, child mortality, years of schooling and two indicators of assets. The advent of the Sustainable Development Goals (SDGs) in 2015 has provided base for improvement in MPI-I for better reflecting SDG indicators. In order to get these improvements, a joint Global Multidimensional Poverty Index was first published in 2018. It built on the original MPI launched in 2010 and an innovative MPI launched in 2014. The joint global MPI still contains 10 indicators organized into three dimensions, with the same dimensional and weighting structure (Alkire and Jahan, 2018). In the joint global MPI, a person is identified as multidimensionally poor if they are deprived in at least one third of the weighted MPI indicators

(OPHI, 2018). Based on the above background, Multidimensional Poverty Index is estimated by using above mentioned indicators based on methods adopted by UNDP (2018) in this study.

3.1.1 Methodology

Each person is assigned a deprivation score according to his/her household's deprivations in each of the 10 component indicators. To identify the multidimensionally poor, the deprivation scores for each indicator are summed to obtain the household deprivation score. A cut off of 33.3 percent, which is equivalent to 1/3 of the weighted indicators, is used to distinguish between the poor and non-poor. If the deprivation score is 33.3 percent or higher, then household (and everyone in it) is multidimensionally poor. Households with a deprivation score of 20 percent or higher but less than 33.3 percent are near multidimensional poverty. Households with a deprivation score of 50 percent or higher are severely multidimensionally poor (OPHI, 2018).

The headcount ratio, *H*, is the proportion of the multidimensionally poor in the population:

$$H = \frac{q}{n}$$

where *q* is the number of people who are multidimensionally poor and *n* is the total population.

The intensity of poverty, *A*, reflects the proportion of the weighted component indicators in which, on average, poor people are deprived. For poor households only (deprivation score of *c* is 33.3 percent or higher), the deprivation scores are summed and divided by the total number of poor people:

$$A = \frac{\sum \int_{l}^{q} c}{q}$$

where c_i is the deprivation score that the *i*th poor person experiences.

The deprivation score c_i of the *i*th poor person can be expressed as the sum of the weights associated with each indicator *j* (*j* = 1, 2, ..., 10) in which person *i* is deprived,

$$ci = ci1 + ci2 + \ldots + ci10.$$

The MPI value is the product of two measures: the multidimensional poverty headcount ratio and the intensity of poverty.

$$MPI = H \,.\, A$$

The contribution of dimension *k* to multidimensional poverty can be expressed as

$$Contrib\ k\ = \frac{\sum_{j \in k} \sum_{1}^{q} c}{n} / MPI$$

The *Contrib k* is the contribution of dimension k to multidimensional poverty.

3.2 MPI Studies in India and World

In recent years, various studies on measurement of multidimensional poverty are undertaken all over the world. Oshio & Kan (2014) investigated the associations between multidimensional poverty and health variables in Japan by using four dimensions of poverty such as income, education, social protection, and housing conditions. Further, Wang & Wang (2016) analysed multidimensional poverty from the perspective of combining socioeconomics and human geography using GIS application for counties[12] of Hechi City, China. Santos et al. (2017) studied the spatial behaviour of poverty in the state of Bahia in 2000 and 2010 using the MPI and Goli et al. (2019) adopted the more robust method of MPI compared with global MPI of UNDP, particularly regarding indicators, their definitions and dimensional structure for examining the extent of regional inequality in multidimensional poverty in Nepal.

There are also some empirical studies on multidimensional poverty measures in India (Chakravarty and D'Ambrosio, 2006; Jayaraj & Subramanian, 2010; Debnath and Shah, 2015 & 2020; Mishra & Gupta (2019). Jayaraj & Subramanian (2010) estimated Multidimensional Poverty Index for major states in India by using the estimated methods proposed by Chakravarty and D'Ambrosio (2006). They used eight specific dimensions to measure poverty and found that multidimensional poverty in India has declined between 1991-92 and 2005-06. The study shows that multidimensional poverty has not fallen uniformly across different population subgroups at the national level. Further, Mohanty (2011, 2012) attempts to find out the linkage between MPI with health and health care utilisation based on NFHS-3 database and observed that children belonging to MPI poor households were more likely to be deprived of health care and lower survival.

[12] There are 11 counties under the jurisdiction of Hetchi City; among which seven are belonging to the national key poverty-stricken counties and other four counties are classified as province-level.

Debnath and Shah (2015) conducted a survey among 300 households in the Sepahijala district of Tripura to estimate Multidimensional Poverty Index by using the Alkire–Foster poverty method and found diversity in multidimensional deprivation between the two administrative regions within the same block. They found that the inhabitats of village committees were more deprived than that of the gram panchayats.

Mishra & Gupta (2019) attempted to explain multiple deprivations of households with and without children and found out the factors responsible for the deprivation of the households with children. They analysed different pillars of well-being in the context of individual deprivation, household deprivation as well as overall deprivation, using the India Human Development Survey (2011-12). They concluded that multiple deprivations among households with children in India were strikingly high.

Debnath and Shah (2020) estimate multidimensional poverty for Tripura based on NFHS database at three points of time to find out the changes in the situation of poverty by using the counting approach developed by Alkire and Foster. They found that Tripura's performance had improved in each of the indicators and the reduction of poverty in terms of MPI and incidence was higher in rural areas while the reduction in the intensity of poverty was lower in rural areas as compared to urban areas.

3.3 Multidimensional Poverty in India

Poverty is measured by unidimensional framework in India. The methodology of poverty estimation is based on the recommendations made by expert groups constituted by the Planning Commission from time to time. As per the Tendulkar Committee estimates, 21.9 percent of the Indian population were living below the poverty line in 2011-12, while corresponding figure was 29.5 percent according to the Rangarajan Committee estimates due to difference in methodology (Planning Commission, 2014). Due to inadequacy of reliable poverty measures there is a need of multidimensional poverty estimation in India. According to United Nations report, India's MPI value is 0.123. It is reduced from 0.283 to 0.123 during the period between 2005-06 and 2015-16. The incidence of multidimensional poverty in India has declined from 640 million people to 369 million people during the period (UNDP & OPHI, 2019). So, India has recorded the fastest reductions in the MPI index values during the period.

There is considerable variation in MPI values across Indian states (Table 3.1). Table also shows whether the change in state's rank is positive, negative or neutral in the corresponding period. If the state has improved its rank, then it is positive, if no change in the rank, it is neutral and if the state's rank is declined, then it is considered negative. Kerala has remained at the top position due to the sincere efforts made by the state government to implement the human development programme since the 1950s and 1960s (Goswami & Bezbaruah, 2011). Kerala and Delhi are the only states which have maintained their positions consistently at the top of the rankings. Sikkim and Andhra Pradesh have performed very well during last ten years and have jumped up 8^{th} rank to 3^{rd} rank and 16^{th} rank to 11^{th} rank respectively. Gujarat is the only state whose ranking has fallen 10^{th} rank in 2005-06 to 17^{th} rank in 2015-16. One reason may be low per capita social sector spending (Goswami & Bezbaruah, 2011) and a significant deceleration in the growth of per capita expenditures in the period 2004 to 2012 (Pangaria et al., 2014). Bihar, Jharkhand, Uttar Pradesh and Madhya Pradesh are the states that got lower ranks among the Indian states in terms of MPI. Although the MPI values have gone down over time for these states, the rankings of these states in the list have not improved. This implies that the other states have performed better in comparison of these states. Kannan and Raveendran also find a high incidence of poverty and high social inequality in Uttar Pradesh. The reason may be stark social hierarchy (Kannan & Raveendran, 2011).

Table 3.1: Multidimensional Poverty Index of Indian States and its Rank in 2005-06 and 2015-16

State	MPI Index (2005-06)	Rank	MPI Index (2015-16)	Rank	Difference in Ranks	Observation
Andhra Pradesh	0.236	16	0.067	11	5	Positive
Arunachal Pradesh	0.313	20	0.108	19	1	Positive
Assam	0.317	21	0.162	25	-4	Negative
Bihar	0.449	29	0.248	29	0	Neutral
Chhattisgarh	0.355	25	0.153	23	2	Positive
Delhi	0.058	2	0.018	2	0	Neutral
Goa	0.088	3	0.020	4	-1	Negative
Gujarat	0.185	10	0.092	17	-7	Negative
Haryana	0.187	12	0.046	9	3	Positive
Himachal Pradesh	0.129	5	0.030	7	-2	Negative
Jammu And Kashmir	0.193	13	0.064	10	3	Positive
Jharkhand	0.429	28	0.208	28	0	Neutral
Karnataka	0.229	15	0.069	12	3	Positive
Kerala	0.053	1	0.004	1	0	Neutral
Madhya Pradesh	0.366	27	0.182	26	1	Positive

Maharashtra	0.186	11	0.071	13	-2	Negative
Manipur	0.204	14	0.085	15	-1	Negative
Meghalaya	0.340	24	0.146	22	2	Positive
Mizoram	0.139	6	0.044	8	-2	Negative
Nagaland	0.295	18	0.099	18	0	Neutral
Odisha	0.336	23	0.156	24	-1	Negative
Punjab	0.108	4	0.025	5	-1	Negative
Rajasthan	0.332	22	0.145	21	1	Positive
Sikkim	0.177	8	0.019	3	5	Positive
Tamil Nadu	0.157	7	0.027	6	1	Positive
Tripura	0.265	17	0.087	16	1	Positive
Uttar Pradesh	0.361	26	0.183	27	-1	Negative
Uttarakhand	0.182	9	0.072	14	-5	Negative
West Bengal	0.302	19	0.110	20	-1	Negative

Source: Computed from the data provided by Global Multidimensional Poverty Index, 2019.

3.4 Multidimensional Poverty Index in the Study Area

Multidimensional Poverty Index is estimated in this study by using the dual cut-off method based on counting approach developed by Alkire and Foster. It uses information from 10 indicators that are organized into three dimensions: health, education, and living standards, based on the methods adopted by UNDP (2018). The Alkire and Foster assigns equal weight to each dimension. Each indicator within a dimension is also equally weighted. While the health and education dimension consist of two indicators each, the standard of living of the household is captured by six indicators. To derive multidimensional poverty, the head count ratio (H) and intensity of poverty (A) are computed. The information regarding height and weight of each of the individual members of the sampled households has been collected using steel tape and floor weighting machine carried with ourselves for the purpose of measuring nutritional status. Information regarding mortality (children 0-5years), educational attainment etc. have been collected through information provided by the parents of the respective households. Other information such as sanitation, drinking water, housing or flooring, cooking fuel and electricity connection have been collected through personal observation and recorded in the questionnaire.

The results show that there is no MPI poor in the non-slum areas. The reason is that the MPI index is based on the three dimensions, viz., education, health and living standard. All school-aged children attend the school and every household has access to improved drinking

water and sanitation facility, electricity, LPG gas, livable house and assets in non-slum areas. However, it is found some deprivation in non-slum households on health dimension, such as in nutrition indicator. The MPI index is 0.278 with nearly 49.8 percent population are multidimensionally poor and the intensity of the poverty is 55.87 percent with respect to the whole study group (Table 3.2). Regarding the comparative performances of the notified slum and non-notified slum areas in terms of MPI, the MPI equals to 0.549 for non-notified slums which is about 2 times higher the MPI for notified slums (0.277). On the other hand, incidence of poverty for non-notified slums is 88.69 percent and that for notified slums is 59.24 percent on multidimensional poverty. Thus, about 30 percent more people are multidimensionally poor in the non-notified slum areas in comparison to the notified slums while intensity of poverty in non-notified slums is 61.85 percent and in notified slums is 46.84 percent.

Table 3.2: Type of Household-wise MPI Index of Study Area

	Notified Slum Households	Non-notified Slum Households	Total Sampled Households
Headcount Ratio	59.24	88.69	49.83
Intensity of Poverty	46.84	61.85	55.87
MPI Index	0.277	0.549	0.278

Source: Primary Data.

The government should not only concentrate on headcount ratio and intensity of poverty, but it is also important to keep watch on those people who are vulnerable and about to move into poverty, i.e., close to the one-third threshold. The MPI measure also classifies those individuals as vulnerable to multidimensional poverty if they are deprived in 20 percent to 33.33 percent of weighted indicators and also specifies a higher poverty cut off for those who deprived in 50 percent or more of the dimensions are identified as severe poor. As per these cut offs, 10 percent of total sampled population are vulnerable to poverty and about 30 percent of sample population are in severe poverty (Table 3.3). The comparative analysis between notified and non-notified slums shows that the conditions of non-notified slum households are miserable as 72 percent individuals of non-notified slums are in severe poverty as compared with 17 percent individuals of notified slums. An important fact has also come in the analysis that there are more vulnerable people in notified slums as compared with non-notified slums.

Table 3.3: Type of Poverty among Population in Notified and Non-notified Slum Households

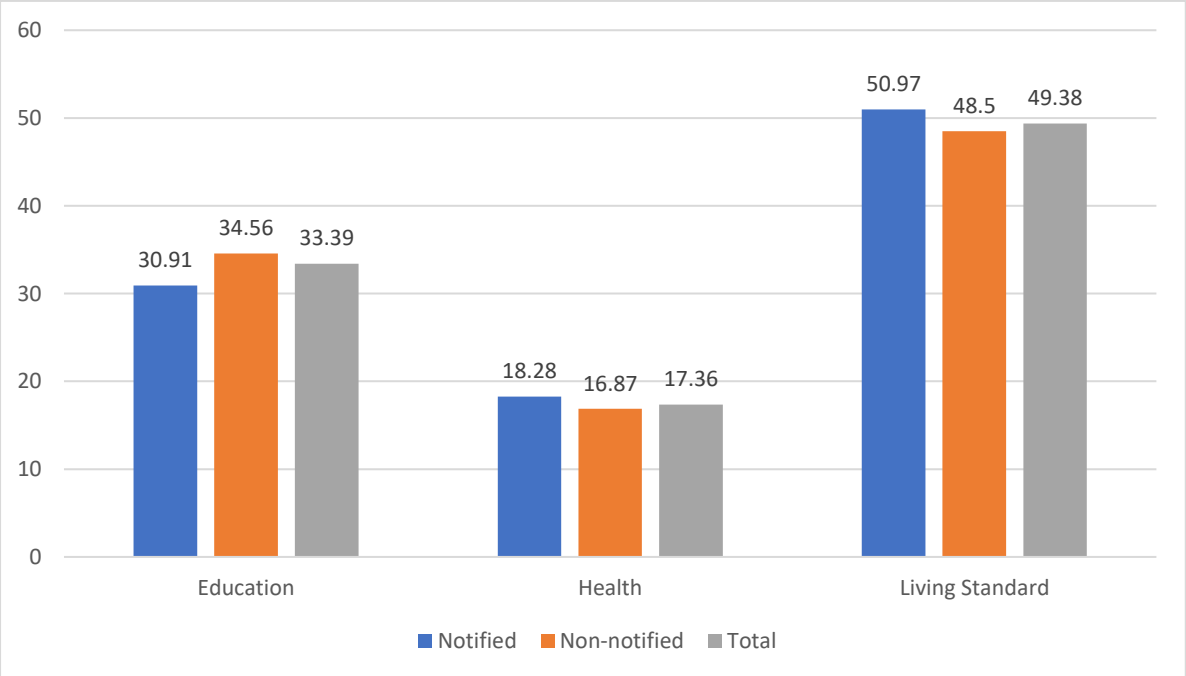
	Notified Slum Population	Non-notified Slum Population	Total
Headcount Ratio	234 (59.24)	353 (88.69)	587 (49.83)
Vulnerable	80 (20.25)	45 (11.31)	125 (10.61)
Severe Poverty	68 (17.22)	287 (72.11)	355 (30.14)

Source: Primary Data.

3.4.1 Decomposition of MPI by Dimensions:

Living standard contributes the most in MPI index among three dimensions for both notified and non-notified slums (Figure 3.1). For notified slums living standard contributes more than 50 percent as compared to 48 percent of non-notified slums. It is also proved by a study that the standard of living indicators have the strongest contribution to multidimensional poverty in poorer states (Dotter & Klasen, 2014). However, there is not much difference in the pattern of dimensions; living standard is at the first position for both types of slums while education and health are at 2nd and 3rd.

Figure 3.1: Percentage Contribution of Deprivations of each Dimension to Multidimensional Poverty Index



Source: Primary Data.

3.4.2 Component wise Decomposition of MPI:

Education

1. School attainment - The household is considered deprived in school attainment if no household member has completed six years of schooling (Alkire et al., 2018). About 78 percent households of non-notified slum are deprived in school attainment while the corresponding figures for notified slum and non-slum households are 43 percent and 5 percent respectively. Caste-wise analysis shows that 54 percent and 52 percent of populations are deprived in OBC and SC community respectively, while only 15 percent general category households are deprived in this category.

2. School attendance - The household is considered deprived in school attendance if any school-aged child in the household is not attending school up to the age at which he/she would complete class 8 (Alkire et al., 2018). About 16 percent sampled households are deprived in this indicator out of this, 74 percent households are belonged to non-notified slums. This indicates that the condition of non-notified slums in education dimension is very severe. Muslim households are more deprived in this indicator as compared to Hindu households. Caste-wise observation confirms that households belong to OBC are most deprived in this indicator.

Health

3. Nutrition - The household is considered deprived in this indicator if any member under 70 years of age or any child in the household is malnourished[13]. About 25 percent sampled households are deprived in nutrition. Further, results show that 6 percent general category, 32 percent OBC and 34 percent SC households are deprived in this indicator.

4. Child mortality - The household is considered deprived in this indicator if any child has died in the family during the past five years. Only six percent sampled households are deprived

[13] Children under 5 years are considered undernourished if their z-score of height-for-age is below minus two standard deviations from the median of the reference population. 5 to 20 years of age are identified as malnourished if their age-specific BMI cutoffs are below minus two standard deviations. Adults 20 to 70 years are considered malnourished if their Body Mass Index (BMI) is below 18.5.

in this indicator and corresponding figure for non-notified slum dwellers is 10 percent. Religion-wise analysis shows that 14 percent Muslim households are deprived in this indicator while corresponding figure is only 4 percent for Hindu households.

Standard of living

5. Electricity - The household is considered deprived in electricity if the household has no electricity. Electricity is available in almost every house of notified slums and 50 percent houses of non-notified slums. OBC and Muslim households are more deprived in this indicator as compared to other categories and religion. However, it can be said that sampled households are least deprived in it among all indicators related to standard of living.

6. Drinking water - The household is considered deprived in this indicator if the household does not have access to improved drinking water or safe drinking water is at least a 30 minute walk from home, round trip. The analysis shows that about 94 percent non-notified slum households are deprived in access to safe drinking water as they are not recognized by the government, so any type of public facility can't reach to these areas.

7. Sanitation - The household is considered deprived in sanitation if the household's sanitation facility is not improved or it is improved but shared with other households. About 97 percent households of non-notified slum are deprived in sanitation facility while the corresponding figures for notified slum and non-slum households are 76 percent and 3 percent respectively. Caste-wise analysis shows that 75 percent OBC and 75 percent SC households are deprived in this category. The reason may be that the slums are mostly concentrated by the lower castes (Kumar et al., 2009) and the number of slum households is double as compared to non-slum households in this analysis.

8. Housing - The household is considered deprived in this indicator if housing materials for at least one of roof, walls and floor are inadequate: the floor is of natural materials and/or the roof and/or walls are of natural or rudimentary materials. All non-notified slum dwellers are deprived in this indicator. Religion-wise analysis finds households belong to Muslim religion are more deprived in housing indicator as compared to other religions.

9. Cooking fuel - The households are considered deprived in cooking fuel if they cook with dung, wood, charcoal or coal. About 57 percent sampled households are deprived in this indicator out of this, 55 percent households are belonged to non-notified slums. Caste-wise analysis shows not much difference between OBC and SC category, i.e. 71.6 percent and 72.1

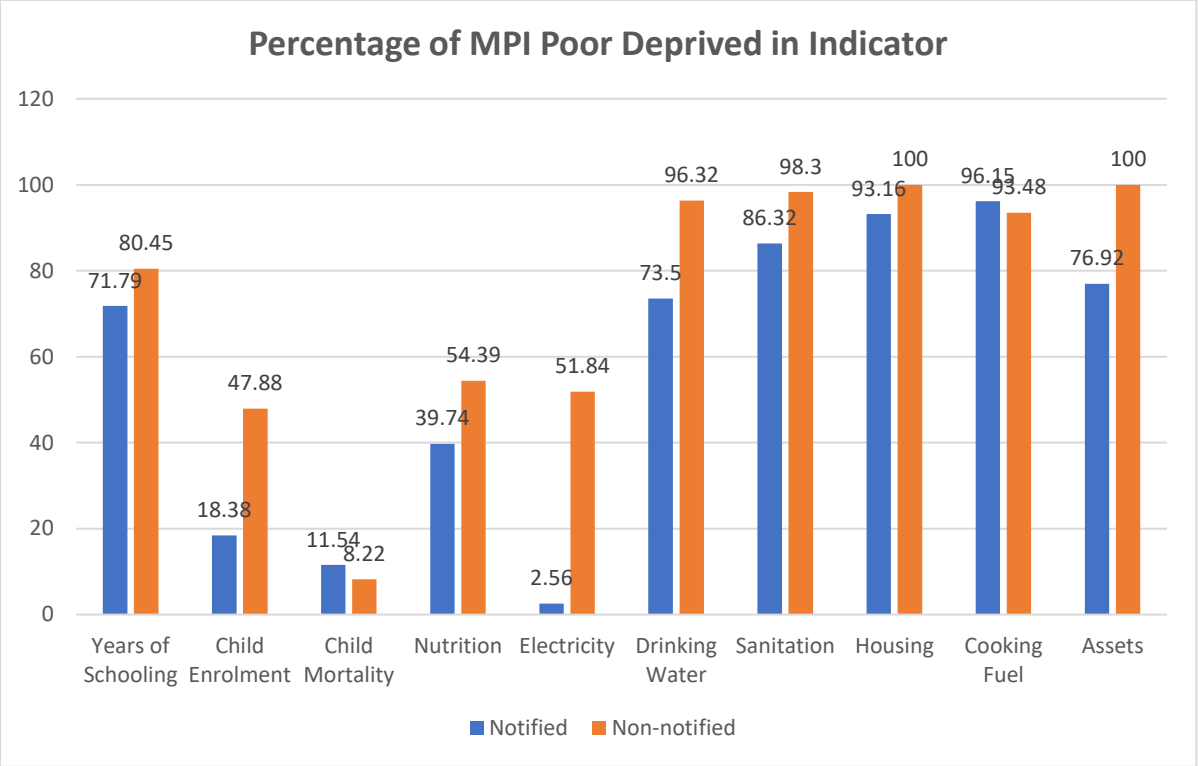
percent respectively while only 27 percent general category households are deprived in this category.

10. Assets - The household is considered deprived if the household does not own more than one of these assets: radio, television, telephone, computer, animal cart, bicycle, motorbike or refrigerator, and does not own a car or truck. It is the second indicator related to standard of living in which all non-notified slum dwellers are deprived while 55 percent notified slum dwellers do not have more than one of these assets. Religion-wise analysis shows that 76 percent Muslim households are deprived in this indicator while corresponding figure is 45 percent for Hindu households. A study also finds that the minority community, particularly Muslims, in India have been more deprived compared to Hindus and other communities for historical reasons (Das, 2015).

The Alkire and Foster methodology has a property, i.e., dimensional breakdown that makes the global MPI even more useful. The MPI can be consistently broken down by each of its indicators by using this property. The censored headcount ratio shows the extent of deprivations among the poor. The censored headcount ratio of an indicator is the percentage of the population who are multidimensionally poor and simultaneously deprived in that indicator. It is higher for indicators related to living standard dimension than other dimensions among all MPI poor of the study area. Censored headcount ratio is the highest for the housing indicator and the lowest for the electricity among all MPI poor of the study area. In this regard, nearly 77 percent MPI poor are deprived in years of schooling indicator.

Comparative analysis of censored headcount ratio between notified and non-notified slums shows that non-notified slums are relatively deprived in majority of indicators except child mortality and cooking fuel (Figure 3.2). The difference of censored headcount ratio between notified and non-notified slums is the highest for electricity indicator, followed by child enrolment. The extent of deprivation among MPI poor is highest in terms of assets and housing, i.e., 100 percent in non-notified slums.

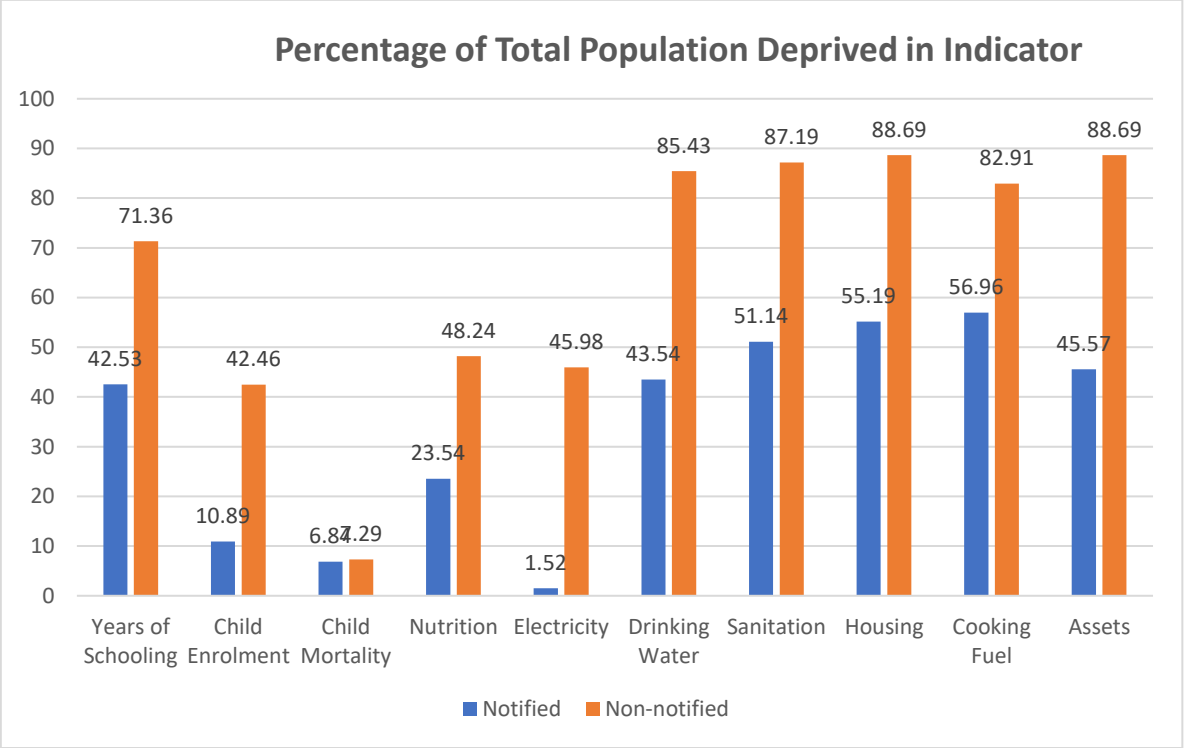
Figure 3.2: Censored Headcount Ratios of Notified & Non-notified Slums



Source: Primary Data.

The uncensored (raw) headcount ratio of a dimension is defined as the proportion of the population that are deprived in that dimension (Seth & Alkire, 2021). It aggregates deprivations pertaining to the poor with deprivations among the non-poor. Uncensored headcount ratio is also higher for indicators related to living standard dimension than that of other dimensions in the study area. The Figure 3.3 presents comparative analysis on account of deprivation to individual indicators for both notified and non-notified slums taking into consideration both the poor and non-poor. Non-notified slums are relatively deprived in majority of indicators except child mortality (Figure 3.3). There is similar percentage of deprived people for child mortality indicator in both types of slums.

Figure 3.3: Uncensored Headcount Ratios of Notified & Non-notified Slums

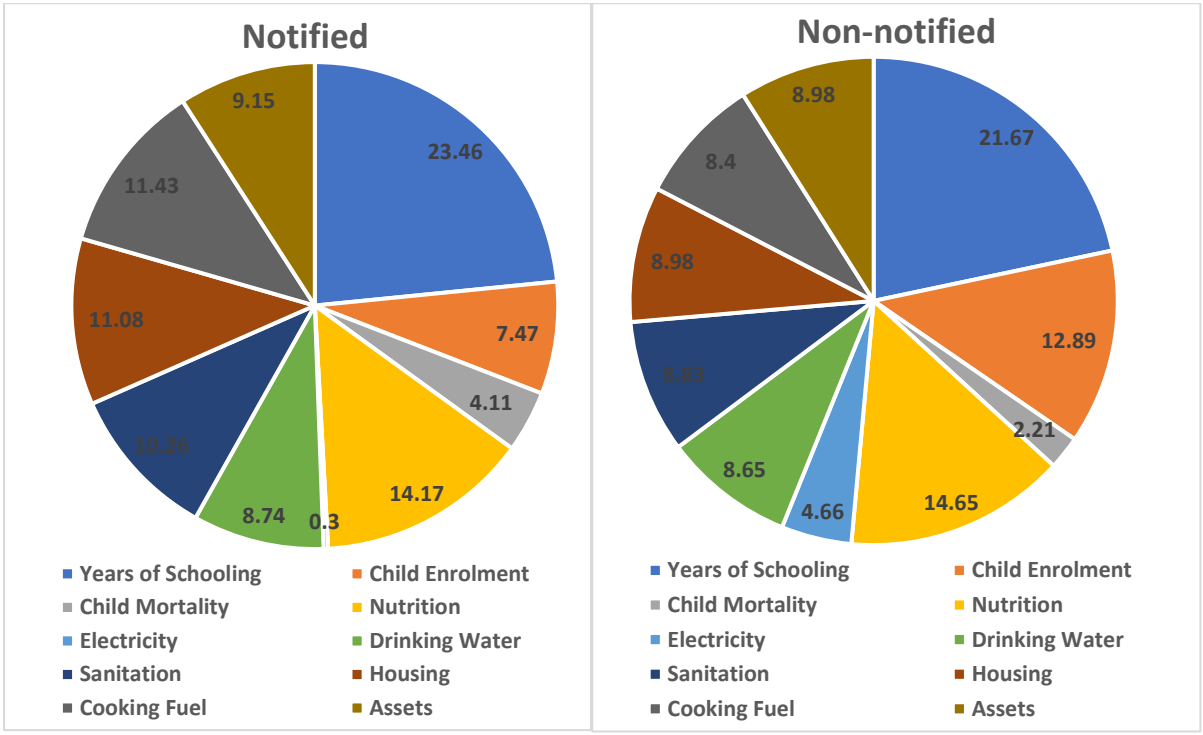


Source: Primary Data.

3.4.3 Percentage Contribution

The percent contribution does not show the extent of deprivation among the poor. It depends on both censored headcount ratio and on the weight assigned to each indicator. This is the reason that more people are deprived in sanitation, cooking fuel, housing and assets than nutrition and years of schooling and nutrition (Figure 3.2) but years of schooling is the largest contributor to Multidimensional poverty in both notified and non-notified slums (Figure 3.4). Electricity contributes least at 0.3 percent in notified slums and child mortality contributes least at 2.21 percent in non-notified slums.

Figure 3.4: Contribution of Individual Indicators to MPI in Notified and Non-notified Slums



Source: Primary Data.

3.4.4 Inequality in MPI across Slums in Lucknow

Extensive disparities in Multidimensional Poverty Index across slums in Lucknow is confirmed. The variation is not only found between notified and non-notified slums but also within both types of slums. The range of MPI value is 0.083 in Chota Burha slum to 0.464 in Behasa slum among all sampled notified slums. While the headcount ratio is varied from 18 percent in Chota Burha slum to 93 percent in Luvkush Nagar slum (Table 3.4). Intensity of poverty is the highest in Shahnazaf Imambara slum and the least in Sudarshan Puri slum. Multidimensional poverty index is least in Chota Burha slum among all slums, but 45 percent population of this slum is in vulnerable condition which reflects they are deprived in more than 20 percent and less than 33 percent dimensions. On the other hand, 23 percent population of Bhikhumpur slum is deprived in more than 50 percent dimensions of MPI index.

The condition is very pathetic in non-notified slums. There are five slums, i.e., Baluadda, Jawahar Nagar, Amausi, Cheeken wali Guli and Luvkush Nagar where all sampled population is MPI based poor. The worst condition is found in Jawahar Nagar slum which is

situated besides railway track at Daliganj ward in Zone 3. The MPI value is 0.724 and all slumdwellers are suffering from severe poverty in this slum. The constitution designates certain urban areas (including railways, airports, and seaports) as being under the jurisdiction of the central government and a recent study also found that slums on central government land experience greater deprivation as compared on state land (Nolan et al., 2018). In terms of MPI value and headcount ratio, Baba Purwa slum is in best position while in terms of intensity of poverty, Ricksaw Colony slum is in better condition than any other sampled non-notified slums.

Table 3.4: Multidimensional Poverty Index in different Slums in Lucknow

Zone	Slum Name	Headcount Ratio	Intensity	MPI Value
Notified Slums				
1	Shahnazaf Imambara	56	51.02	0.286
2	Sudarshan Puri	23	41.69	0.097
3	Buroolia	52	43.77	0.224
4	Bhikhumpur	65	49.43	0.319
5	Chota Burha	18	46.05	0.083
6	Dubbaga	60	44.28	0.264
7	Luvkush Nagar	93	44.56	0.419
8	Behasa	91	50.93	0.464
	Average	59.24	46.84	0.277
Non-Notified Slums				
1	Baluadda	100	53.44	0.534
2	Majharuislam Madarsa	91	62.78	0.564
3	Jawahar Nagar	100	72.4	0.724
4	Baba Purwa	54	58.69	0.319
5	Amausi	100	67.38	0.673
6	Cheeken wali Guli	100	56.33	0.563
7	Luvkush Nagar	100	67.44	0.677
8	Ricksaw Calony	78	47.63	0.374
	Average	88.69	61.85	0.549

Source: Primary Data.

3.4.5 Predictors of Multidimensional Poverty

Education Level and MPI

Numerous evidences apparently pointed out that the level of education has a direct relationship with multidimensional poverty as education level of the household head increases, the percentage of MPI poor households decreases **(**Kannan & Raveendran, 2011**)**. For example,

about 90 percent households are MPI poor in illiterate group while the corresponding figures for primary, junior, intermediate, graduate groups are 62.5 percent, 42.9 percent, 28.6 percent, 2.6 percent respectively (Table 3.5). The reason is level of education enhances capabilities. It determines earning level, activity pattern and standard of living. A study also finds close association between educational incapability and poverty and vulnerability (Kannan & Raveendran, 2011).

Table 3.5: Education-wise Multidimensional Poverty in Lucknow

Education Level	Non-poor	MPI Poor	Total
Illiterate	10.42	89.58	100
	8.26	72.27	40
Primary	37.5	62.5	100
	4.96	8.4	6.67
Junior	57.14	42.86	100
	13.22	10.08	11.67
Intermediate	71.43	28.57	100
	20.66	8.4	14.58
Graduate	97.44	2.56	100
	31.4	0.84	16.25
Post-Graduate & Professionals	100	00	100
	21.49	00	10.83

Source: Primary Data.

Occupational Status and MPI

Occupational status also affects multidimensional poverty as the occupation of the head decides the regularity and volume of income of the family. The analysis shows that the percentage of MPI poor is the highest for causal labours. Half of the MPI households are those whose household heads are causal labours while the corresponding figures for regular wage and self-employed are 31 percent and 17 percent (Table 3.6).

Table 3.6: Occupation-wise Multidimensional Poverty in Lucknow

Occupation	Non-poor	MPI Poor	Total
Self Employed	63.64	36.36	100
	28.93	16.81	22.92
Professionals & Semi-professionals	100	00	100
	4.96	00	2.5
Salaried / Regular Wage	61.05	38.95	100
	47.93	31.09	39.58
Casual Labour	14.29	85.71	100
	8.26	50.42	29.17
Others	85.71	14.29	100
	9.92	1.68	5.83

Source: Primary Data.

Income Level and MPI

Income is expected to be negatively related to MPI. Lower income households are expected to be MPI poor more than those who have higher income. This study is based on urban poverty and urban poor have to buy almost everything from the market. So income is one of the important factors of MPI. We have classified sampled households into four groups; lower, lower-middle, middle and upper income group on the basis of per capita income. As the study incorporates slum and non-slum households and household size is varied in the study area, so per capita monthly income of the household is used instead of total income. The analysis shows that the percentage of MPI poor is higher for lower income groups and lower-middle income groups than other groups (Table 3.7).

Table 3.7: Income level-wise Multidimensional Poverty in Lucknow

Income Group	Non-poor	MPI Poor	Total
Lower Income	5.56	94.44	100
	2.48	42.86	22.5
Lower-middle Income	39.05	60.95	100
	33.88	53.78	43.75
Middle Income	92.73	7.27	100
	42.15	3.36	22.92
Upper Income	100	00	100
	21.49	00	10.83

Note: 2000 & less per capita-lower income-lower income; 2001 to 5000 per capita-lower-middle income; 5001 to 15000 per capita- middle income & above 15000 per capita- upper income

Source: Primary Data.

Social Group and MPI

As per the study of Kannan & Raveendran (2011), social group and the low level of education have significant effects on poverty and it is also found in the study, as only 19 percent of general category households are MPI poor as compared to 65 percent OBC households and 61 percent SC households (Table 3.8). The reason may be that slum dwellers are mostly belong to OBC and SC category whether they live in notified slums or non-notified slums and a study also found that incidence of poverty is higher among the lower castes than in other categories in the slums (Kumar et al., 2009). A recent global report also found that in India, five out of six multidimensionally poor people are from lower tribes or castes (UNDP & OPHI, 2021).

Table 3.8: Caste-wise Multidimensional Poverty in Lucknow

Caste	Non-poor	MPI Poor	Total
General	80.52	19.48	100
	50.82	12.71	22.5
OBC	35.29	64.71	100
	29.51	55.93	43.75
SC	39.34	60.66	100
	19.67	31.36	22.92

Source: Primary Data.

3.4.6 Empirical Analysis

To find out the determinants of multidimensional poverty, a multivariate analysis has been carried out. The dependent variable 'multidimensional poverty' is a binary variable and it takes a value 1 for households whose deprivation score is 33.3 percent or higher and 0 is otherwise. Because of the dichotomous nature of the dependent variable, binary logistic regression is used. Based on descriptive statistics, the socio-economic factors such as family size, education, income level, occupation and social category are considered as independent variables and an empirical model has been developed as follows:

$$\text{Log } \lambda_i = \alpha + \beta_1 \text{SIZE} + \beta_2 \text{SOG} + \beta_3 \text{INC} + \beta_4 \text{OCC} + \varepsilon_i$$

Where λ_i denotes multidimensional poverty, SIZE means family size, SOG means social group, INC means income, OCC means occupation, and ε_i is error term.

Variables that significantly influence multidimensional poverty are family size, income and caste, whereas occupation is statistically insignificant, though it is important. The estimated coefficients confirm that income plays a strong significant association with multidimensional poverty (Table 3.9). Household size is negatively and significantly related to dependent variable. This indicates that the probability of being MPI poor decreases as family size increases. The reason may be more earning members in a large family. With respect to social group, the positive coefficient implies that the probability of being MPI poor for OBC and SC groups is higher than Other category. This is consistent with the result that the living standards of OBCs, SCs and STs, are substantially lower than those of others (Gang et al., 2011). Numerous studies have also observed that disadvantaged groups are disproportionately affected by different types of deprivations in India. Deshpande (2003) has found a strong relationship between low-caste status and poverty on the basis of the National Sample Survey Organisation (NSSO) consumption data.

Per capita income is better for comparison as family size is varied in the study area. In the regression analysis, per capita income of household member is used. Income has a negative effect on the incidence of multidimensional poverty. Odd ratio reveals that the probability of being MPI poor decreases by 0.99 unit when income of the household increases by 1 unit. However, occupation variable is not significant but positive sign of casual labour denotes that if a household head is causal labour, the probability of being MPI poor increases.

The LR statistics reveals that model is significant at 1 percent and pseudo R-squared value indicate that the variation explained by all the independent variables is 50.43 percent. Thus the result of logit model reveals that probability of being MPI poor is significantly very high if the per capita income of household is less and it belongs to lower caste.

Table 3.9: Logistic Regression for Determinants of Multidimensional Poverty

Variables	Description of Variables	Coefficient	Z	P value	Odd Ratio
Size	Household size	-0.282	-2.42	0.015	0.754
Caste	OBC =1, others =0	0.852	1.69	0.092	2.345
Caste	SC =1, others =0	1.256	2.22	0.026	3.511
PCI	Per capita income	-0.0009	-5.14	0.000	0.999
Occupation	Causal labour =1, others =0	0.414	0.86	0.387	1.512
Constant		4.255	3.66	0.000	70.478
	Log Likelihood	-82.452			
	LR chi^2 (5)	167.74 (0.000)			
	Pseduo R^2	0.5043			

3.5 Summary & Conclusions

The chapter highlights the existing disparities in multidimensional poverty at state level in India and at district level in Uttar Pradesh. At the state level, the disparities in multidimensional poverty can be seen to vary from a low of 0.004 in Kerala to a high of 0.248 in Bihar. However, MPI values of states are reduced during the period between 2005-06 and 2015-16, but the rankings of Bihar, Jharkhand and Uttar Pradesh have not improved during the period.

Multidimensional Poverty Index has been estimated by using the dual cut-off method based on counting approach developed by Alkire and Foster for slum and non-slum households in Lucknow district. The analysis finds no MPI poor in the non-slum areas, however, deprivation in health dimension, such as in nutrition indicator is observed. The study reveals

wide disparity in terms of headcount ratio, intensity of poverty and MPI values among different types of households. The MPI value of non-notified slums (0.549) is about 2 times higher than the MPI value of notified slums (0.277). The comparative analysis between notified and non-notified slums shows that the condition of non-notified slum households are miserable as 72 percent of populations of non-notified slums are suffering from severe poverty as compared to 17 percent populations of notified slums. Living standard contributes the most in MPI index among three dimensions for both notified and non-notified slums. High incidence of the standard of living poverty is also a reflection of poor provision of basic needs of life. The analysis also finds unevenly distributed multidimensional poverty across slums in Lucknow, where Chota Burha slum, a notified slum of zone 5 is least deprived while Jawahar Nagar slum, a non-notified slum of Zone 3 is most deprived among all slums.

The results of multivariate logistic regression clearly confirm that the variables such as family size, income and caste have significant impact on multidimensional poverty. It can be said that the probability of being MPI poor is significantly very high if the household belongs to lower income group in lower caste such as SC and OBC community. So, significant governmental efforts for improvement of educational standards including skill development are required to directly increase income and reduce poverty in slum areas.

CHAPTER - 4

Status of Wash Conditions in Lucknow

4.0 Introduction

Drinking water and sanitation are important basic needs of every human. The National Water Policy has assigned highest priority to drinking water supply followed by irrigation, hydropower, navigation, industrial and other uses. According to the Constitution of India, water supply is a state subject and the Union Government is responsible for setting water quality standards only (Srikanth, 2009). In Uttar Pradesh, the main agency for both urban and rural water supply is Uttar Pradesh Jal Nigam (UPJN). It is constituted as an autonomous corporation, but works under the control of the state government (GOI, 2007). The World Health Organization (WHO) has put India in the league of countries with the one of the best access to improved drinking water sources, though it still has huge problems with sanitation (WHO, 2017). Poor sanitation nullifies health gains from clean drinking water.

4.1 Drinking Water and Sanitation Facility at Global Level

WHO and UNICEF established the Joint Monitoring Programme (JMP) for water supply, sanitation and hygiene in 1990. JMP has established a standard set of categories to analyze drinking water and sanitation data because definitions of improved drinking water and sanitation facilities can vary widely among countries. The JMP has further divided improved drinking water[14] facility into three categories: limited, basic and safely managed services (WHO, 2017). As per modified classification of drinking water, safely managed drinking water refers to drinking water from an improved water source that is located on premises, available when needed and free from faecal and priority chemical contamination. Whereas, basic drinking water refers to drinking water from an improved source, provided collection time including queuing is not more than 30 minutes for a round trip. On the other hand, limited drinking water refers to water from an improved source for which collection time including queuing exceeds 30 minutes for a round trip. The biggest challenge that many regions face in reporting on safely managed drinking water services is the lack of representative data on drinking water quality. In the absence of such data, access to basic drinking water facility is reported in the Table 1. As per modified definition, 90 percent of the world's population use basic drinking water facility (both safely managed and basic facility) while 10 percent people (785 million people) still lacked even basic drinking water services (Table 4.1). Among these, eight out of ten lived in rural areas. Nearly half lived in Least Developed Countries (UN-Water,

[14] An improved source of drinking water includes bottled water, piped water into the dwelling, yard or plot, public tap or standpipe, tube-well or borehole, protected dug well, protected spring, and rainwater collection (NSSO, 2013).

2020). Countries in the region of Sub-Saharan Africa still lack substantially towards basic drinking water facility.

Table 4.1: Regional Drinking Water Coverage at Global Level in 2017 (in percent)

Region	Safely Managed	Basic	Limited	Unimproved	Surface Water
Australia & New Zealand	--	99	1	0	0
Central & Southern Asia	60	33	1	5	1
Eastern & South-Eastern Asia	--	93	1	5	1
Europe & Northern America	95	4	1	0	0
Latin America & the Caribbean	74	23	0	2	1
Northern Africa & Western Asia	--	92	5	2	1
Oceania	--	55	2	6	37
Sub-Saharan Africa	27	34	13	18	8
Least Developed Countries	35	30	13	15	7
Landlocked Developing Countries	35	29	3	10	7
Small Island Developing States	--	83	3	7	7
World	71	19	2	6	2

Source: UNICEF & WHO, 2019.

The JMP has also divided improved sanitation facility[15] into three categories: limited, basic and safely managed services. People using improved facilities which are shared with other households will be classified as having a limited service. Improved facilities that are not shared count as either basic or safely managed services, depending on how excreta are managed. If the excreta from improved sanitation facilities are not safely managed then people using those facilities will be classified as having a basic sanitation service. Safely managed sanitation services is defined as the population using an improved sanitation facility that is not shared with other households and where excreta are disposed of in situ or transported and treated off-site (WHO, 2017). With the SDG focus on safe management of excreta, it is useful to distinguish between sewerage and non-sewerage sanitation facilities, as they require different forms of excreta management. The idea behind this is that people must excrete hygienically but also that their excreta must be contained or treated to avoid adversely affecting their health or that of other people. However, the data required to estimate basic drinking water, sanitation and hygiene services are readily available for most countries, the JMP has not found sufficient data to estimate safely managed sanitation services in all countries (UNICEF &

[15] An improved sanitation facility is one that hygienically separates human excreta from human contact. It includes following facilities such as flush / pour flush to piped sewer system, septic tank and pit latrine, ventilated improved pit (VIP) latrine, pit latrine with slab and composting toilet (NSSO, 2013).

WHO, 2019). About 45 percent of the world's population use safely managed sanitation facility and 29 percent use basic facility while 26 percent people still lacked even basic sanitation facility (Table 4.2). Seven out of ten people who still lacked even basic services lived in rural areas and three out of ten lived in Least Developed Countries. 673 million people still practiced open defecation (UN-Water, 2020). Countries in the region of Oceania, Sub-Saharan Africa, Central and Southern Asia lacks substantially the basic sanitary facility i.e., 70 percent, 69 percent and 39 percent respectively.

Table 4.2: Regional Sanitation Coverage at Global Level in 2017 (in percent)

Region	Safely Managed	Basic	Limited	Unimproved	Open Defecation
Australia & New Zealand	72	27	1	0	0
Central & Southern Asia	--	61	12	7	20
Eastern & South-Eastern Asia	64	20	6	7	3
Europe & Northern America	76	22	0	2	0
Latin America & the Caribbean	31	56	5	6	2
Northern Africa & Western Asia	38	50	4	5	3
Oceania	--	30	4	52	14
Sub-Saharan Africa	18	13	18	31	20
Least Developed Countries	--	34	15	32	18
Landlocked Developing Countries	--	41	11	30	19
Small Island Developing States	--	69	9	15	7
World	45	29	8	9	9

Source: UNICEF & WHO, 2019.

4.2 Drinking Water and Sanitation Facility at National Level

About 90 percent households in India have accessibility to improved drinking water source. The accessibility of drinking water to various sources varies across rural and urban areas in India. In Urban India, 69 percent households obtain their drinking water from piped water (52.1 percent into dwelling & 16.9 percent from public tap). On the other hand, 51 percent households depend on tube-well/handpump for their drinking water in rural areas (Table 4.3). It can be said that piped water is the major source of drinking water in urban areas while tube well/hand-pump is the major source of drinking water in rural areas. However, condition is improving in rural India and as per latest report, 40.5 percent population was getting safe and adequate drinking water within premises through piped water supply in 2019 (GOI, 2020). There has been increase in the coverage of improved drinking water from 88.1 percent in 2005-06 to 89.9 percent in 2015-16.

Table 4.3: Percentage Distribution of Households by Principal Source of Drinking Water

Source of Drinking Water	Rural		Urban		Total	
	2005-06	2015-16	2005-06	2015-16	2005-06	2015-16
Improved Sources	84.5	89.3	95	91.1	87.9	89.9
Piped water into Dwelling	11.8	18.4	50.7	52.1	24.5	30.1
Public tap / stand pipe	16.1	15.3	20.3	16.9	17.5	15.9
Tube-well / hand-pump	53.2	50.9	21.3	17.4	42.8	39.2
Other improved	3.4	4.7	2.7	4.7	3.1	4.7
Unimproved source	15.4	10.7	4.8	8.9	11.9	10.1

Source: Computed from the data provided by NFHS-3(2005-06) & NFHS-4(2015-16).

One of the important parameter of drinking water, i.e., drinking water facility within premises has improved from 42.1 percent in 2005-06 to 58 percent in 2015-16 in rural India, whereas the corresponding figure for drinking water has increased from 70.5 percent in 2005-06 to 81.6 percent in urban India in 2015-16 (Table 4.4). However, the percentage of households having principal source of drinking water outside premises has substantially decreased in both rural and urban areas.

Table 4.4: Percentage distribution of households by distance to the principal source of drinking water

Time to obtain drinking water (round trip)	Rural		Urban		Total	
	2005-06	2015-16	2005-06	2015-16	2005-06	2015-16
Within Premises	42.1	58	70.5	81.6	51.3	66.3
Less than 30 minutes	43.3	33.6	22.4	15.3	36.5	27.2
30 minutes or longer	14.6	8.4	7.1	3.1	12.1	6.5

Source: Computed from the data provided by NFHS-3 (2005-06) & NFHS-4 (2015-16).

Sanitation refers to the measures, methods and activities that prevent the transmission of diseases and safeguard public health. A sustainable sanitation system includes all the components such as physical parts and actions that require to adequately managing human waste. There is wide urban-rural disparity in each component of sanitation facility in India. However, sanitation facility is not satisfactory in India, as about 39 percent households have no access to any type of sanitation facility, but it is better in urban areas as compared to rural areas. Widespread open defecation in rural India is not because of poverty or educational deprivation but due to beliefs, values and norms about purity, pollution, caste and untouchability that cause people to reject affordable latrines, i.e., pit latrines (Shukla, R., 2018). The percentage of households having no latrine decreased to 10.5 percent in urban areas and 54.1 percent in rural areas (Table 4.5). Another important aspect of the sanitation facility is whether the households have access to improved source of latrine. A stark gap can be seen in

access to improved sanitation facility between urban and rural areas. About 70 percent households in urban areas have improved sanitation facility while only 36.7 percent households in rural areas have this kind of facility.

Table 4.5: Percent Distribution of Households by Types of Sanitation Facility

Sanitation facility	Rural		Urban		Total	
	2005-06	2015-16	2005-06	2015-16	2005-06	2015-16
Improved, not shared	17.6	36.7	52.8	70.3	**29.1**	**48.4**
Flush/septic tank/ pit latrine	15.3	31.2	51.1	67.2	27	43.7
Pit latrine with slab	2.3	5.5	1.6	3.1	2.1	4.7
Improved but shared	**5.3**	**6.1**	**24.2**	**14.9**	**11.5**	9.1
Flush/septic tank/ pit latrine	3.1	5	14.4	13.9	7.8	8
Pit latrine with slab	2.2	1	9.4	1	3.5	1.1
Other	0.1	0.1	0.4	0	0.2	00
Unimproved	3.1	3.1	6.2	4.3	4.1	3.6
No facility/ open defecation	74	54.1	16.8	10.5	55.3	38.9

Source: Computed from the data provided by NFHS-3(2005-06) & NFHS-4(2015-16).

4.2.1 Drinking Water and Sanitation Facility at Regional Level

There is considerable variation in access to drinking water source across regions in India. The best drinking water facility is available in all states of western region where nearby 81 percent households have access to tap water from treated source while eastern region has lowest access to tap water as 45 percent households use hand-pump to fulfil their need (Table 4.6). Only 20 percent households of Bihar have access to tap water while other 75 percent households use hand-pump. The reason may be less economic development of the state as many studies have related drinking water facility with economic development.

Table 4.6: Percent Distribution of Urban Households by Sources of Drinking Water at Regional Level

Region	Tap water from Treated Source	Tap water from Un-treated Source	Hand-pump	Tube-well
North	74.9	8	13.9	1.4
Central	46.5	12.2	35.03	3.3
East	35.5	5.9	45.4	11.4
Northeast	46.2	17.8	14.7	9.6
West	80.8	7.5	6.1	3.8
South	60.2	9.6	10	17.5
India	**62**	**8.6**	**20.8**	**6.2**

Source: Estimated from Household (HH)-6 Tables of Census, 2011.

Sanitation Facility

The coverage of sanitation facility is the highest in all states of Northeast India where nearby 95 percent households get the benefits of sanitation facility while eastern region has worst (Table 4.7). A wide disparity can be seen in use of different types of toilet facility across regions, i.e., 81 percent urban households in north region use water closet while corresponding figure in east region is only 62 percent. Water closet is considered better toilet facility than others (Shukla, 2018). It can be said that the best sanitation facilities are found in north region. 19 percent households in northeast states use pit latrines while only 2 percent households in central region use this type of facility.

Table 4.7: Percent Distribution of Urban Households by Types of Sanitation Facility at Regional Level

Region	Water Closet	Pit latrine	Other latrine	No latrine
North	81	4.8	3.5	10.7
Central	69.1	1.9	1.5	27.5
East	62.1	8.3	1.1	28.5
Northeast	74.3	19.1	1.7	4.9
West	77.7	2.7	1	18.6
South	73.5	11.2	1.5	11.9
India	**72.6**	**7.1**	**1.7**	**18.6**

Source: Estimated from Household (HH)-8 Tables of Census, 2011.

4.3 Drinking Water and Sanitation Facility at State Level

A significant difference can be seen in access to drinking water sources between slum and urban households in Uttar Pradesh and India. About 74 percent slum households of India use tap and only 12 percent use handpump for drinking purpose. On the other hand, 45 percent slum households in Uttar Pradesh have access to tap water and another 42 percent depend on handpump (Table 4.8). The same picture can be seen for urban households in Uttar Pradesh and India. It can be said that in India, the major source of drinking water is piped water while in Uttar Pradesh, it is piped water and handpump. The reason may be intermittent water supply coupled with low levels of urbanization has led to better availability and reliability of other water sources in Uttar Pradesh (Tiwari & Nayak, 2017).

Table 4.8: Percentage Distribution of Slum Households & Urban Households by Main Source of Drinking Water in Uttar Pradesh and India

Source of Drinking Water	Slum Households		Urban Households	
	Uttar Pradesh	India	Uttar Pradesh	India
Tap water from Treated Source	38.6	65.3	44.7	62
Tap water from Un-treated Source	6.8	8.7	6.9	8.6
Handpump	42	12.7	46.3	11.9
Tube-well / Borehole	10.2	7.6	1.9	8.9
Covered well	0.4	0.8	0.3	1.7
Unimproved Sources	2	4.9	0.2	6.9

Source: Estimated from Household (HH)-6 Tables of Census, 2011.

Nevertheless, location of drinking water sources reflects a different picture between slum households and urban households in Uttar Pradesh and India. In India, nearly 71 percent urban households get their drinking water within the premises, whereas 79 percent urban households get their water within the premises in Uttar Pradesh. Therefore, as is clearly reflected, a greater percentage of urban and slum households in Uttar Pradesh have access to water within the premises, than is available to these types of households in India. However, the difference is more for slum households (Table 4.9).

Table 4.9: Percentage distribution of households by distance to the principal source of drinking water

Source of Drinking Water	Slum Households		Urban Households	
	Uttar Pradesh	India	Uttar Pradesh	India
Within Premises	71	56.7	78.8	71.2
Near Premises	21.7	31.9	16	20.7
Away	7.3	11.4	5.2	8.1

Source: Estimated from Household (HH)-6 Tables of Census, 2011.

There is considerable variation in access to different type of toilet facility between slum and urban households in Uttar Pradesh and India. About 73 percent urban households and 58 percent slum households in India use water closet while the corresponding figure for Uttar Pradesh is 77 percent and 71 percent respectively. However, the percentage of households having flush latrine connected to piped sewer system is higher in India as compared to Uttar Pradesh (Table 4.10).

Table 4.10: Percentage Distribution of Slum Households & Urban Households by Types of Sanitation Facility in Uttar Pradesh and India

Sanitation facility	Slum Households		Urban Households	
	Uttar Pradesh	India	Uttar Pradesh	India
Flush latrine connected to piped sewer system	20.5	24.5	28.3	32.7
Connected to septic tank	47.4	31.4	46.9	38.2
Connected to other system	2.7	1.9	2	1.7
Pit latrine	3.1	6.2	2.9	7.1
Other latrine	3.7	2	3	1.7
Public Latrine	3.8	15.1	2.1	6
Open defecation	18.8	18.9	14.8	12.6

Source: Estimated from Household (HH)-8 Tables of Census, 2011.

4.4 WASH Conditions in the Slum & Non-slum Area of Lucknow

4.4.1 Drinking Water Facility

There are five principal sources of drinking water; viz., piped water, public tap, bore-well, community owned bore-well and hand-pump in the study area. The majority of the sampled households depend on municipal water supply, i.e. 39 percent. Access to underground water is the next most important source account for 24 percent households depend on community owned bore-well and 13 percent households depend on bore-well, while 22 percent households obtain their drinking water from public tap. Only 3.75 percent sampled households obtain their drinking water from hand-pump. The reason may be low water level which compels households to invest in booster pumps so that community owned bore-well and public tap have become the most preferred drinking water source in the slums (Table 4.11). It is also found that about 90 percent bore-well users and more than 57 percent piped water users are non-slum households while more than 72 percent community owned bore-well users live in non-notified slums. Community owned bore-well is the bore-well made by the local governing body at public expenditure or made by a community institution. For example, in Majharuislam Madarsa, a non-notified slum of zone 2, all households obtain their drinking water from a tank filled by community based bore-well which is owned by Madarsa. On the other hand, in Cheekan Wali Gali, a non-notified slum of zone 6, and in Jawahar Nagar, a non-notified slum of zone 3, all households obtain their drinking water from a tank filled by community based bore-well which is owned by local governing body. In zone 2, 5 and 8, more than half of the household of notified slum, i.e., Sudarshan Puri, Chota Burha, Behasa, stake drinking water from municipal piped water while 90 percent households of Baba Purwa (notified slum), 60

percent households of Baluadda (notified slum) and 50 percent households of Shahnajaf Imambara (notified slum) obtain their drinking water from public tap. Though providing water via public taps and hand-pumps are important but may not be up to the mark for not only health risk but also the opportunity cost of time lost in collecting water (Paul et al., 2004; Seetharam & Rao, 2009; WSP Study, 2011). Caste-wise analysis shows that General category households have greater access to piped water supply and bore-well as compared to households belonged to OBC and SC category.

Table 4.11: Distribution of Households by Drinking Water Source (in percent)

Type of Households	Piped Water	Public Tap	Bore-well	Community owned Bore-well	Hand-pump	Others	Total
Non-slum	63.75	--	35	--	--	1.25	100
	57.3	--	90.32	--	--	100	33.33
Notified	42.5	28.75	3.75	20	5	--	100
	38.2	44.23	9.68	27.59	44.44	--	33.33
Non-notified	5	36.25	--	52.5	6.25	--	100
	4.49	55.77	--	72.41	55.56	--	33.33
Total	37.08	21.67	12.92	24.17	3.75	0.42	100
	100	100	100	100	100	100	100

Source: Estimated from Field Survey Data, May-June 2019.

Note: Chi2=164.1, Pr=0.00 percent, level of significance is at 1 percent.

There is considerable variation in access to drinking water source between notified slum and non-notified slum. Community owned bore-well is the main source for non-notified slums while municipal water supply is for notified slums. It is also seen that households of notified and non-notified slums have diversified sources of drinking water[16] than the non-slum households as people lived in slums do not avail of bore-wells and have few piped water connections. They have to fetch their water from public tap, community owned bore-well or hand-pumps. The households of non-slum areas are least diversified (Table 4.12). The reason

[16] The sources of drinking water considered here for determining the Herfindahl index include municipal piped water, public tap, bore-well, community owned bore-well and public tap. Diversification index is defined as the deduction of Herfindahl index from 1.

may be all households have piped water or bore-well and they store water in big tanks for whole day, and so the people do not need to look for other sources of drinking water (Tiwari, 2017).

Table 4.12: The Herfindahl Index for Water Source Diversification by Type of Households

Type of Households	Herfindahl Index	Diversification Index
Non-slum Households	0.5291	0.4709
Notified Slum	0.3072	0.6928
Non-notified Slum	0.4134	0.5866

Source: Computed from Field Survey Data, May-June 2019.

Mere availability of drinking water from different sources even in sufficient quantities to the households may not reflect the whole gamut of facility of drinking water enjoyed by the households (NSSO, 2010). In this regard, the distance travelled by the households to access the source of drinking water is an important aspect, which needs to be analyzed. Distance to the water source from the house affects the volume of water consumed. Availability of drinking water within the household or within the premises of the household is definitely a better form of facility, since in such cases the household members need not travel to fetch drinking water (Tiwari, 2017). There are significant disparities among non-slum areas, notified slums and non-notified slums with regard to distance to drinking water source (Table 4.13). About 43 percent sampled households get their drinking water within dwelling. Out of which, three-forth households are non-slum households while only one-fourth households are slum dwellers. It may be noted that the notified slum dwellers share the highest proportion of drinking water source outside dwelling within premises while non-notified slum dwellers have to go far for obtain water. About 98 percent households of non-slum area obtain their drinking water within dwelling while 31 percent households of notified slum and only 1 percent households of non-notified slum have this facility within dwelling. 77 percent households of non-notified slums have to go far for getting their water as their slums are still not recognized by the governments and their application for piped water connection is rejected by the department (Satapathy, 2014).

Table 4.13: Distribution of Households by Distance to Water Source (in percent)

Type of Households	Within Dwelling	Outside Dwelling within Premises	At Distance < 0.2 km	At Distance 0.2-0.5 km	Total
Non-slum	97.5	1.25	1.25	--	100
	75	2.13	1.79	--	33.33
Notified	31.25	36.25	27.5	5	100
	24.04	61.7	39.29	12.12	33.33
Non-notified	1.25	21.25	41.25	36.25	100
	0.96	36.17	58.93	87.88	33.33
Total	43.33	19.58	23.33	13.75	100
	100	100	100	100	100

Source: Estimated from Field Survey Data, May-June 2019.

Note: Chi2=187.98, Pr=0.00 percent, level of significance is at 1 percent.

4.4.2 Sanitation Facility

Bathroom Facility

Nearly 70 percent households have bathroom facility while 30 percent households have no bathroom. A vast disparity can be seen in access to bathroom facility among different types of households. It is found that non-slum households have higher access to attached bathroom while notified slum dwellers have higher access to detached bathroom as compared to all sampled households. 81 percent households in non-slum area have attached bathroom whereas the corresponding figure is 5 percent in notified slums and only 2.5 percent in non-notified slums (Table 4.14). Detached bathroom is mainly found in notified slums and about 69 percent non-notified slum dwellers have no bathroom facility. Across the slums, Amausi and Jawahar Nagar are the slums where none of the households have bathroom facility as all the households were residing in jhopdis or katcha structure. Both are non-notified slums. In Babapurwa, 70 percent households have bathroom which is the highest among all non-notified slums while in Dubbaga, a notified slum, all households have this facility. The condition of non-notified slum dwellers is pathetic as majority of them do not have bathroom facility as they live in jhopdis.

Table 4.14: Distribution of Households by Bathroom Facility (in percent)

Type of Households	Attached Bathroom	Detached Bathroom	No Bathroom	Total
Non-slum	81.25	18.75	00	100
	91.55	15.15	00	33.33
Notified	5	76.25	18.75	100
	5.63	61.62	21.43	33.33
Non-notified	2.5	28.75	68.75	100
	2.82	23.23	78.57	33.33
Total	29.58	41.25	29.17	100
	100	100	100	100

Source: Estimated from Field Survey Data, May-June 2019.

Note: Chi2=214.26, Pr=0.00 percent, level of significance is at 1 percent.

Toilet Facility

Nearly 33 percent sampled households use toilets with 'flush/pour flush connected to the sewer system and 39 percent households use septic tank while 3 percent households use pit latrine and 25 percent households defecate openly. There is considerable variation in access to toilet facility among different types of households. About 94 percent households of non-slum area use toilets with 'flush/pour flush connected to the sewer system', while 81 percent households of notified slums use septic tank (Table 4.15). On the other hand, 65 percent households of non-notified slums practiced open defecation. It is also found that more than two-third septic tank users are notified slum dwellers while pit latrine users are both notified as well as non-notified slum dwellers. The sanitation condition of non-notified slums is worst among all slums, especially in Amausi, Baluadda and Jawahar Nagar. In Jawahar Nagar slum under Daliganj ward, households defecate openly near the railway track. The reason may be their poverty. A recent study also finds that poverty is an important barrier in access to improved sanitation facility (Shukla, R., 2018). Caste-wise variation in access to toilet facility is also found in the study area. General category households have higher access to toilets with 'flush/pour flush connected to the sewer system' as compared to OBCs and SCs, i.e., 66 percent, 18 percent and 16 percent respectively while about 30 percent households belonged to OBC and SC category defecate openly among total sampled households.

Table 4.15: Distribution of Households by Type of Toilet Facility (in percent)

Type of Households	Flush/pour to piped sewer	Septic Tank	Pit Latrine	Open Defecation	Total
Non-slum	93.75	6.25	--	--	100
	94.94	5.32	--	--	33.33
Notified	5	81.25	5	8.75	100
	5.06	69.15	50	11.86	33.33
Non-notified	--	30	5	65	100
	--	25.53	50	88.14	33.33
Total	32.92	39.17	3.33	24.58	100
	100	100	100	100	100

Source: Estimated from Field Survey Data, May-June 2019.

Note: Chi2=280.22, Pr=0.00 percent, level of significance is at 1 percent.

The diversification index also provides evidence that accessibility to toilet facility for households of non-notified slums is the most diversified compared to other households (Table 4.16). The reason is that the global burden of poor access to safe drinking water and sanitation falls primarily on the poorest of the poor (Phansalkar, 2007; Tiwari & Nayak, 2017), and households of the non-notified slums are very poor.

Table 4.16: The Herfindahl Index for Sanitation Facility Diversification by Type of Households

Type of Households	Herfindahl Index	Diversification Index
Non-slum Households	0.8828	0.1172
Notified Slum	0.6728	0.3272
Non-notified Slum	0.5150	0.4850

Source: Computed from Field Survey Data, May-June 2019.

The survey data reveals that nearly 77 percent households have sanitation facilities whereas about 35 percent of households have common sanitation facilities. Sanitation facilities that are shared among households, whether fully public or accessible only to some, are not considered improved (WSP Report, 2011). The reasons are categorized in terms of cleanliness and accessibility. Cleanliness refers to toilets may not be hygienic and fully separate human waste from contact with users and whereas accessibility refers to facilities may not be available

at night, or used by children (WHO, 2012). So, only 41 percent households in study area have improved sanitation facility. A stark gap can be seen in accessibility to the latrine among different type of households in the study area. In non-slum areas, nearly 79 percent of the households have their own toilets, whereas the corresponding figures are 24 percent for the notified slums and only 2.5 percent for the non-notified slums (Table 4.17).

Table 4.17: Distribution of Households by Access to Toilet Facility (in percent)

Type of Households	Exclusive Use of Households	Common Use of Households in Building	Public Latrine with Payment	Public Latrine without Payment	No Latrine	Total
Non-slum	97.5	2.5	--	--	--	100
	78.79	2.47	--	--	--	33.33
Notified	23.75	67.5	5	3.75	--	100
	19.19	66.67	30.77	60	--	33.33
Non-notified	2.5	30	5	1.25	61.25	100
	2.02	30.86	69.23	40	100	33.33
Total	41.25	33.33	0.42	1.67	23.33	100
	100	100	100	100	100	100

Source: Estimated from Field Survey Data, May-June 2019.

Note: Chi2=242.91, Pr=0.00 percent, level of significance is at 1 percent.

4.4.3 Hygiene Facility

Hygiene refers to those practices that help to maintain health and prevent the spread of diseases. Some aspects of drinking water such as its storage and mode of taking out water from the container are very important for personal hygiene. Four types of mode for taking out drinking water are noticed in the survey area; through tap, poured out, vessel with handle and vessel without handle. Tap is the major mode of non-slum households while majority of slum dwellers use vessel without handle dipped in to take out water (Table 4.18). The reason may be more awareness of healthy practices of non-slum households. The data also reveals that about three-fourth households use plastic container for storage of drinking water while rest of the households use container of stainless steel. Only one household uses copper container for drinking water. The analysis shows that type of household affects material of container as 84

percent notified slum dwellers and 91 percent non-notified slum dwellers use plastic while more than half non-slum households use stainless steel.

Table 4.18: Distribution of Households by Mode of taking out Water (in percent)

Type of Households	Vessel without Handle	Poured out	Through Tap	Vessel with Handle	Total
Non-slum	00	15	62.5	22.5	100
	00	26.09	100	36	33.33
Notified	53.75	27.5	00	18.75	100
	45.74	47.83	00	30	33.33
Non-notified	63.75	15	00	21.25	100
	54.26	26.09	00	34	33.33
Total	39.17	19.17	20.83	20.83	100
	100	100	100	100	100

Source: Estimated from Field Survey Data, May-June 2019.

Note: Chi2=152.65, Pr=0.00 percent, level of significance is at 1 percent.

Hygiene has long established links with public health. The COVID-19 pandemic has highlighted the importance of hand hygiene for preventing and controlling the spread of infectious diseases (UN-Water, 2020). It is now included in SDG targets. The JMP has classified hygiene facility into three categories, viz, basic facility, limited facility and no facility. Basic hygiene facility refers to availability of a handwashing facility on premises with soap and water while limited hygiene facility refers to availability of a handwashing facility on premises with lack of soap or water. No facility means absence of handwashing facility on premises (UNICEF & WHO, 2017). According to JMP classification, about 53 percent households of study area have basic hygiene facility while 40 percent households have limited hygiene facility (Table 4.19). It is also found that most of the non-slum households wash their hands under tap with use of soap while most of the notified slum dwellers who have access to basic hygiene facility wash their hands by using water from bucket. Habit of washing hands before preparing and taking foods and after defecating is also very important aspect of hygiene. Data are also collected on these aspects and it is observed that slum dwellers are not very habitual about these habits, however, they wash their hands regularly after defecating. It is also

found that Hindu and upper caste households have higher access to basic hygiene facility as compared to Muslims and disadvantaged groups.

Table 4.19: Distribution of Households by Type of Hygiene Facility (in percent)

Type of Households	Under Tap Using Soap	Water from Bucket with Soap	Lack of Soap or Water	No Handwashing Facility	Total
Non-slum	88.75	11.25	--	--	100
	95.95	16.36	--	--	33.33
Notified	3.75	38.75	51.25	6.25	100
	4.05	56.36	43.16	31.25	33.33
Non-notified	--	18.75	67.5	13.75	100
	--	27.27	56.84	68.75	33.33
Total	30.83	22.92	39.58	6.67	100
	100	100	100	100	100

Source: Estimated from Field Survey Data, May-June 2019.

Note: Chi2=206.38, Pr=0.00 percent, level of significance is at 1 percent.

4.4.4 Micro Environment

The micro environment refers to the environment at local level while the macro environment refers to the environment at all levels above local level – for example, district, provincial, national and international. Apart from drinking water and sanitation facilities, some micro environmental facilities such as; availability of sewer lines and drainage system, facility of garbage disposal system also play an important role to keep the residents healthy. About 46 percent households report that sanitation system of their respective houses is connected with the underground sewer system. Out of which 73 percent households are non-slum households and rest of the households are notified slum dwellers (Table 4.20). The condition of the non-notified slum dwellers is more vulnerable as none of the non-notified slum house is connected with underground sewer system while all non-slum houses are connected with underground system. Nearly 38 percent of the notified slum dwellers responded that sanitation system of their respective houses is connected with the sewer system of the slum areas. Across the

notified slums, most of the households is connected with the sewer system in Buroolia, Chota Burha, Sudarshan puri.

Table 4.20: Distribution of Households by Sewerage System (in percent)

Type of Households	Underground Sewage System	No Underground Sewer	Total
Non-slum	100	00	100
	72.73	00	33.33
Notified	37.5	62.5	100
	27.27	38.46	33.33
Non-notified	00	100	100
	00	61.54	33.33
Total	45.83	54.17	100
	100	100	100

Source: Estimated from Field Survey Data, May-June 2019.

Note: Chi2=164.48, Pr=0.00 percent, level of significance is at 1 percent.

A wide disparity can be seen in availability of drainage system among different types of households. 'Underground drainage' is the most common type of drainage system in non-slum areas i e., 62.5 percent. Furthermore, 'open pucca' and 'open kachcha' are the most prevalent drainage system in notified slums and non-notified slums respectively. It is observed that nearly 20 percent non-notified slum dwellers have no facility of drainage system and those have the system, i.e., 67.5 percent, that is nothing but the 'open kachcha' (Table 4.21). So, the condition of non-notified slum dwellers is much vulnerable as maximum time a lot of garbage are dumped into the drainage system and it does not work properly. Across non-notified slums, 'Jawahar Nagar' has not a single dwelling connected with drainage system. On the other hand, in Baluadda all the households are connected with 'open kachcha' fallowed by Behasa, Cheeken wali Guli, Majharuislam Madarsa and Ricksaw Calony.

Table 4.21: Distribution of Households by Availability of Drainage System (in percent)

Type of Households	Underground	Covered Pucca	Open Pucca	Open Kachcha	No Drainage	Total
Non-slum	62.5	25	8.75	3.75	00	100
	100	86.96	8.33	4.48	00	33.33
Notified	00	3.75	83.75	12.5	00	100
	00	13.04	79.76	14.93	00	33.33
Non-notified	00	00	12.5	67.5	20	100
	00	00	11.9	80.6	100	33.33
Total	20.83	9.58	35	27.92	6.67	100
	100	100	100	100	100	100

Source: Estimated from Field Survey Data, May-June 2019.

Note: Chi2=312.44, Pr=0.00 percent, level of significance is at 1 percent.

Questions about garbage disposal and dumping sites are also asked in the survey. Majority of non-slum households report that garbage is collected by municipality, i e., 87.5 percent while 58.75 percent notified slum dwellers complain for no arrangement for garbage disposal (Table 4.22). The condition of non-notified slum dwellers is very severe as all of them report that there are no arrangements of garbage collection by local government or municipality and about 88 percent households report that there is no fixed place to dispose of their domestic garbage. They dispose their domestic garbage at anywhere they found suitable place.

Table 4.22: Collection and Disposal of Garbage in Different Types of Households (in percent)

Quality of Drinking Water	Non-slum Households	Notified Slum Households	Non-notified Slum Households	Total Sampled Households
Collection of garbage				
Municipality	87.5	3.75	00	30.42
Residents	12.5	37.5	00	16.67
No arrangements	00	58.75	100	52.92
Site where collected garbage is disposed				
Outside city	87.5	3.75	00	30.42
Nearby house	11.25	43.75	12.5	22.5
No such place	1.25	52.5	87.5	47.08

Source: Primary Data.

4.5 Factors Influences the WASH Condition of Urban and Slum Households

The analysis is carried out in a binomial logit framework. The estimation is carried out for the 160 sampled slum households, i.e., notified slum and non-notified slum, separately and also for the pooled sample of all the 240 sampled slum and non-slum households as Lucknow is divided into eight zones and 10 households from non-slum area, 10 households from notified slum and 10 households from non-notified slum are selected from each zone. Various socio-economic factors of the households determine the accessibility of WASH facilities. The description of independent variables is given in Table 4.23.

Table 4.23: Description of Independent Variables

Variable	Description
Age	Age of the household's head is a continuous variable.
Education	Education level of the household head is a continuous variable.
Religion	The religion of the household is categorized into two distinct categories, i.e., Hindu and other religion.
Caste	The caste of the household is categorized into three distinct categories, i.e., General, OBC and SC.
Family	The family of the household is classified into two categories, i.e., joint and nuclear.
MPI poor	It is a binary variable, having a value of 1 if the household is MPI poor and 0 otherwise.
Extreme poor	It is a binary variable, having a value of 1 if the household living on less than US$1.90 a day and 0 otherwise.
Poor	It is a binary variable, having a value of 1 if the household living on less than US$3.20 a day and 0 otherwise.
Type of house	The house of the household is categorized into two categories, i.e., pucca house and other type of house.

4.5.1 Determinants of Safe Drinking Water Facility within Premises

Availability of drinking water within premises is a better form of facility as distance to the water source from the house affects the volume of water consumed. In general, the closer water

can be supplied to the dwelling; the better it would be (Bajpai & Bhandari, 2001; Pushpangadan, 2006). The dependent variable is household access to drinking water within premises, which is binary, having a value of 1 if the family has access to safe drinking water within premises and 0 otherwise.

Among the factors on socio-economic profiles of the households, religion, caste, income and housing conditions have significant impact on drinking water in premises in both types of models while age and education of household head make no difference as the variables are statistically insignificant (Table 4.24). Religion has a positive and significant influence on dependent variable. This indicates that the households belonging to Hindu religion are comparatively more likely to have this facility. The odd ratios reveal that the probability of drinking water facility within premises is about 3 times greater for those households belonging to Hindu religion as compared to other religion. The caste of the household head matters significantly in access to drinking water within premises as depicted by results. The negative coefficient of caste dummy implies that drinking water within premises are found to be significantly lower among the households related to OBC and SC category as compared to the general category of households.

To see the effect of poverty in access to basic amenities, we have used multidimensional poor and income poor as dummy variables by using World Bank's popular criteria US$1.90 a day and US$3.20 a day rather than income groups in this analysis. The World Bank defines 'extreme poverty' as living on less than US$1.90 a day. The negative coefficients of regression imply that the households belonging to MPI poor, extreme poor and poor groups are less likely to have drinking water facility within premises as compared to non-poor. However, the coefficient is significant only for MPI poor and extreme poor in both models.

Housing condition also positively and significantly affects access to drinking water within premises. This indicates that residents of pucca houses are comparatively more likely to have this facility. The likelihoodness of getting drinking water facility within premises in both models is 6 times more than those households who live in semi-pucca and kuchcha house.

Table 4.24: Logistic Regression for Drinking Water within Premises

	Model 1 All Households				Model 2 Slum Households			
Variables	**Coefficient**	**Z**	**P value**	**Odd Ratio**	**Coefficient**	**Z**	**P value**	**Odd Ratio**
Age	-0.013	-0.50	0.614	1.013	0.0426	1.44	0.149	1.044
Education	0.088	1.56	0.119	1.092	0.076	1.28	0.201	1.079
Religion; Hindu =1, others	1.183	1.87	0.061	3.264	1.186	1.85	0.065	3.275
Caste; OBC =1, others =0	-1.772	-2.77	0.006	0.170	-2.149	-3.21	0.001	0.117
Caste; SC =1, others =0	-2.547	-3.36	0.001	0.078	-3.178	-3.80	0.000	0.042
Joint family =1, others =0	0.513	0.93	0.354	1.669	0.551	0.96	0.340	1.735
MPI poor	-1.427	-2.66	0.008	0.239	-1.204	-2.07	0.038	0.299
Extreme poor	-1.463	-2.57	0.010	0.232	-1.517	-2.48	0.013	0.219
Poor	-2.295	-1.54	0.124	0.101	-2.515	-1.50	0.134	0.081
House; pucca house =1, others =0	1.933	3.34	0.001	6.909	1.798	2.93	0.003	6.039
Constant	2.545	1.29	0.198	12.738	1.711	0.78	0.436	5.535
Log likelihood = -59.5719					Log likelihood = -53.5676			
LR Chi^2 (10) = 213.55					LR Chi^2 (10) = 77.07			
Prob > Chi^2 = 0.0000					Prob > Chi^2 = 0.0000			
Pseudo R^2 = 0.6419					Pseudo R^2 = 0.4184			

4.5.2 Determinants of Improved Sanitation Facility

This section highlights the determinants of improved sanitation facility. Improved sanitation facility is considered as a dependent variable (1 if the household has improved sanitation facility, 0 otherwise). Variables that significantly influence access to improved sanitation facility are religion, caste, type of family, poverty and housing conditions, whereas age and education are statistically insignificant (Table 4.25).

The estimated coefficients confirm that religion and type of house play strong, positive and significant association with access to improved sanitation facility. The odd ratios of regression also reveal this fact that probability of having improved sanitation facility is 13 times higher in model 1 and 14 times higher in model 2 for the households belonging to Hindu religion as compared to other religion. On the other hand, the likelihoodness of having improved sanitation facility is 22 times higher in model 1 and about 18 times higher in model 2 for the households living in pucca house more than those households who live in semi-pucca and kuchcha house. The negative coefficients of caste indicate that general category households are more likely to have improved sanitation facility as compared to OBC and SC households. However, the coefficient is significant only for SC households in both models.

In model 2, family dummy does not appear to be significant though in the pooled sample (model 1) it is significant at 10 percent level with a positive sign, implying that joint family is more likely to have improved sanitation facility as compared to nuclear family. If a household having joint family, the probability of having improved sanitation facility is about three times higher than nuclear family households. Various types of poverty is negatively related to the dependent variable that means probability of having improved sanitation facility is lower for poor households than non-poor. However, these coefficients are significant only for pooled sample.

Table 4.25: Logistic Regression for Improved Sanitation Facility

	Model 1				**Model 2**			
	All Households				**Slum Households**			
Variables	**Coefficient**	**Z**	**P value**	**Odd Ratio**	**Coefficient**	**Z**	**P value**	**Odd Ratio**
Age	-0.015	-0.49	0.621	0.985	0.012	0.35	0.725	1.013
Education	0.026	0.42	0.672	1.026	-0.010	-0.15	0.884	0.989
Religion; Hindu =1, others	2.603	2.52	0.012	13.506	2.665	2.23	0.026	14.370
Caste; OBC =1, others =0	-0.170	-0.23	0.815	0.844	0.153	0.19	0.850	1.165
Caste; SC =1, others =0	-2.052	-2.35	0.019	0.128	-2.142	-1.84	0.065	0.117
Joint family =1, others =0	1.096	1.72	0.085	2.991	1.074	1.60	0.109	2.928
MPI poor	-0.307	-0.45	0.655	0.736	0.503	0.59	0.555	1.653

Extreme poor	-1.372	-2.00	0.045	0.254	-0.309	-0.39	0.699	0.734
Poor	-2.805	-2.34	0.019	0.060	-2.976	-1.64	0.102	0.051
House; pucca house =1, others =0	3.097	4.82	0.000	22.128	2.882	3.90	0.000	17.842
Constant	-0.252	-0.12	0.906	0.777	-2.846	-1.02	0.308	0.058
Log likelihood = -46.8173					Log likelihood = -38.4503			
LR Chi^2 (10) = 231.69					LR Chi^2 (10) = 47.50			
Prob > Chi^2 = 0.0000					Prob > Chi^2 = 0.0000			
Pseudo R^2 = 0.7122					Pseudo R^2 = 0.3818			

4.5.3 Determinants of Basic Hygiene Facility

In order to understand the factors determining basic hygiene facility, logistic regression is carried out. The dependent variable is binary, assuming the value 1 if household has basic hygiene facility and the 0 if they do not have this facility.

The first determinant of access to basic hygiene facility is the age of the household head. Age is negatively and significantly related to the dependent variable in both models which implies that younger household head has more probability of having basic hygiene facility than older household heads. The reason may be younger people understand importance of hygiene. The next significant variable is caste and the base is general category. The negative coefficients reveal that OBC and SC households are less likely to have basic hygiene facility as compared to general category households in both models (Table 4.26).

Housing condition is also an important determinant of basic hygiene facility. The probability of having basic hygiene facility is 4 times higher in model 1 and about 3 times higher in model 2 for the households living in pucca house more than those households who live in semi-pucca and kuchcha house. The negative coefficient estimates of the various poverty variables denoting that poor are less likely to have basic hygiene facility as compared to non-poor. However, coefficients of extreme poor and poor are only significant in model 1. Education, religion and multidimensional poverty do not play any significant role in having basic hygiene facility.

Table 4.26: Logistic Regression for Basic Hygiene Facility

	Model 1				Model 2			
	All Households				Slum Households			
Variables	**Coefficient**	**Z**	**P value**	**Odd Ratio**	**Coefficient**	**Z**	**P value**	**Odd Ratio**
Age	-0.052	-2.69	0.007	0.949	-0.042	-1.99	0.047	0.959
Education	0.065	1.43	0.154	1.067	0.053	1.14	0.254	1.054
Religion; Hindu =1, others	0.636	1.36	0.174	1.888	0.468	1.01	0.310	1.597
Caste; OBC =1, others =0	-1.034	-2.08	0.038	0.356	-0.888	-1.76	0.078	0.411
Caste; SC =1, others =0	-1.483	-2.64	0.008	0.227	-1.359	-2.31	0.021	0.257
Joint family =1, others =0	0.375	0.89	0.375	1.455	0.328	0.76	0.447	1.388
MPI poor	-0.682	-1.42	0.155	0.506	-0.405	-0.81	0.417	0.667
Extreme poor	-0.988	-2.05	0.041	0.372	-0.645	-1.26	0.206	0.525
Poor	-1.646	-1.76	0.079	0.193	-0.614	-0.52	0.602	0.541
House; pucca house =1, others =0	1.399	2.75	0.006	4.053	1.079	2.05	0.040	2.944
Constant	4.198	2.87	0.004	66.554	2.338	1.45	0.147	10.359
Log likelihood = -91.7182					Log likelihood = -86.0082			
LR Chi^2 (10) = 147.92					LR Chi^2 (10) = 25.13			
Prob > Chi^2 = 0.0000					Prob > Chi^2 = 0.0051			
Pseudo R^2 = 0.4464					Pseudo R^2 = 0.1274			

In all six models, the regressors have a significant impact on their respective dependent variables. It is confirmed by the statistics of the LR test. The first five models are significant at 1 percent level, while the last model is significant at 10 percent level. However, the estimation of determinants of WASH condition is carried out for the slum households separately and also for the pooled sample of slum and non-slum households, but the results show no difference in relation to religion, caste and housing condition categories. Thus, the result of logistic regression reveals that caste, religion, poverty and type of house play discriminative role in access to basic necessities.

4.6 Summary & Conclusions

Adequate water, sanitation and hygiene (WASH) services are essential for health, economic development, and environmental protection. This chapter has made an attempt to present the current status of WASH conditions at national, state and district level and to evaluate inequities in access to drinking water and sanitation facility between slum and non-slum areas in Lucknow. The analysis finds wide urban-rural disparity in each component of WASH conditions in India. A significant difference can be seen in access to drinking water sources between slum and urban households in Uttar Pradesh and India. It can be said that the major source of drinking water is piped water in India while it is piped water and handpump in Uttar Pradesh. However, a greater percentage of urban and slum households in Uttar Pradesh have access to water within the premises than these types of households in India.

There is considerable variation in access to WASH facilities among non-slum areas, notified slums and non-notified slums. Five principal sources of drinking water; viz., piped water, public tap, bore-well, community owned bore-well and hand-pump are found in the study area. The main source of drinking water is piped water and bore-well for non-slum households while community tank and public tap for slum households. It is clearly proved by diversification index that the households of non-notified slums have to face great hardship in accessing drinking water and sanitation facility as compared to other households. None of the non-notified slum house is connected with underground sewer system. More than half non-notified slum dwellers do defecate openly. The main reason is that they do not have latrine facility at their houses. Nolan et al. also found positive and significant relationship between legal status and the severity of deprivation in access to basic services (Nolan et al., 2018). This has important policy implications because it suggests that non-notified slums should be recognized and notified by the state government so that these slums could avail the facilities provided to notified slums by the government.

The results of logistic regression clearly identify that the religion, caste, income and type of house act as important socio-economic factors affecting access to drinking water in premises, improved sanitation facility and basic hygiene facility. However, age and type of family are the other important factors. The estimation is carried out for the slum households separately and also for the pooled sample of slum and non-slum households, but the results show no difference in determining factors in both models.

CHAPTER – 5

Coping Cost: Strategies & Measurement

5.0 Introduction

On 25th September 2015, Member States of the United Nations adopted the 2030 Agenda for Sustainable Development which comprises 17 Sustainable Development Goals (SDGs) and 169 targets addressing social, economic and environmental aspects of development (UNICEF & WHO, 2017). SDG 6.1 is "to achieve universal and equitable access to safe and affordable drinking water for all by 2030". Safely managed drinking water refers to drinking water from an improved water source that is located on premises, available when needed and free from faecal and contamination. It can be said that besides accessibility, water quality, reliability and affordability are also very important. So, SDG targets are far more ambitious than the previous MDG targets and overcome the limitations of the earlier focus on the water source.

5.1 Theoretical Framework

Traditional micro economic theory postulates that market goods are traded in the market through prices, but there is no price for non-market goods. There are two theoretical methods which are used for valuation of non-market goods, viz., revealed preference and stated preference. In revealed preference method, actual behaviour of consumers are revealed in the market while stated preference method uses the stated hypothetical behaviour of consumers in response to hypothetical questions. World Water Development Report (2012) emphasizes on valuation methods, like averting cost, which are not sensitive to value judgements. Revealed preference method-averting behaviour approach has been used in this study. As per averting behaviour approach, WTP depends on any variable that affect the marginal product of pollution, mitigating activities or avoidance cost (Haq et al., 2007).

Theoretical explanations of averting expenditures are based on the household production function theory of consumer behavior (Abdalla et al., 1992). The household production model is a special case of consumption or utility maximization theory (Freeman, 1993). The household combines exogenous and endogenous inputs with a selected quantity of market good such as water purifier to produce a targeted level of satisfaction, i.e., good quality of water (Roy et al., 2004 & Cook et al., 2016). The consumers engage in various averting behaviour to cope with unreliable water quality and bear coping costs. Pattanayak et al. (2005) finds that coping costs and WTP are significantly correlated and coping costs are lower bound for WTP.

5.2 Review of Literature

Poor quality piped water is a serious problem in the developing countries. The households adopt variety of averting and private investment mechanism to combat the irregular and low quality water supply system. They have to bear averting expenditure or coping cost. Various studies find that people are engaged in multiple coping strategies due to inadequate water supply (Zerah, 2000; Pattanayak et al., 2005; Misra & Goldar, 2008; Vasquez et al., 2009; Cook et al., 2016; Majuru et al., 2016; Amit & Sasidharan, 2019). A study on coping strategies of households finds that household water storage is correlated with the hours of water supply in the city of Delhi, India. It was observed that household adopted multiple coping strategies and coping costs varied from 15 percent of income for lower income households compared to 1 percent for rich households (Zerah, 2000).

A study based on a large scale sample based survey from Nepal, examine the coping behavior and its associated costs. The study finds that five types of coping mechanisms are adopted by the households and they spend almost one percent of the income in the form of coping costs. The majority of these costs are attributed to time spent collecting water. Further, the study reveals that drinking water sources, education, income and awareness about water quality have significant effect on coping cost. Coping cost is also called as a lower bound of WTP. The author opined if the coping costs are more than the supply cost of investments, the improvement policy passes a cost-benefit analysis (Pattanayak et al., 2005).

The study on household's coping strategies and associated costs in Delhi brings out the deficiencies in water supply and sewerage services such as limited hours water supply, low pressure and water quality problems. So, the consumers have to invest in large storage, booster pumps, filters, aqua-guards and have to bear the significant coping costs. The average coping cost borne by households is about Rs. 187 per month in 2005. Further, it is also found that unauthorized colonies have to bear higher coping cost as compared to authorized colonies (Misra & Goldar, 2008). Another study in rural Kenya estimates median coping costs are US$ 20 per month. The coping costs include collection costs, purchase costs, storage costs, treatment costs and costs of treating diarrhea. The estimated coping costs are exceeded 10 percent of income for over half of sampled households. The regression result reveals that coping costs are higher among larger and wealthier households, and households whose primary source is not at home (Cook et al., 2016).

A review study of Majuru et al., (2016) on coping strategies finds that unreliable household water supplies impose significant coping burdens on households and low income households often engage in labour and time-intensive coping strategies. The study suggests that the focus should be shifted from coverage of water supplies to improvement of the quality of service for attainment of SDG target 6.1 (Majuru et al., 2016). A recent study also uses coping cost approach to measure affordability of accessing clean water in the city of Chennai, India. The study is based on a cross-sectional data of 423 households. It is observed that household adopted multiple coping strategies, such as collecting, pumping, treating, storing and purchasing. The study observed that average coping costs for piped and non-piped households are about Rs. 553/- per month and Rs. 658/- per month respectively. Further, the study finds that collection costs for non-piped households constitute 22 percent of the total coping costs. It is further observed that estimated coping costs vary from 15 percent of income for lower income households compared to 1 percent for rich households (Amit & Sasidharan, 2019).

5.3 Status of Municipal Water Supply

About 58 percent sampled households use municipal water supply (piped water and public tap) for drinking. Majority of the households reports that water is available twice a day while about 15 percent households say that municipal water is available only once a day (Table 5.1).

Piped water users report more than double as compared to public tap users.

As per JMP classification, those households who report water availability at least 12 hours per day, classified as households having water available most of the time (UNICEF & WHO, 2019). However, it is observed that Lucknow Jal Nigam provides water to the households only 3 to 4 hours every day, so the households of Lucknow do not come under above classification. This is an indication that the majority of the households reveal a shortage of regular water supply. So, the risk of exposure to contaminated water is also increased as intermittent water supply aids degradation of the quality of water (Satapathy, 2014).

Table 5.1: Frequency of Municipal Water Supply

Source	More than Once a Day	Once a Day	Total
Piped Water	93.26	6.74	100
	67.23	28.57	63.12
Public Tap	71.15	28.85	100
	31.09	71.43	36.88
Total	85.1	14.89	100
	100	100	100

Source: Estimated from Field Survey Data, May-June 2019.

Note: Values in the first row reflects row wise percent and values in the second row reflect the column wise percent.

Low pressure is another problem of municipal water supply. About 41 percent of the households reveal that sometimes low pressure occurs in water supply, while 9 percent households reveal that low pressure is always in water supply. It may be noted that 73 percent public tap users complain about low pressure as compared to 36 percent piped water users (Table 5.2). The reason may be usage of booster pumps by piped water users as majority of them use pumps for storing water into overhead tanks while public tap users collect their water in queue by spending a lot of time.

Table 5.2: Intensity of Low Pressure of Municipal Water Supply

Source	No	Sometimes	Always	Total
Piped Water	64.04	31.46	4.49	100
	80.28	48.28	35.53	63.12
Public Tap	26.92	57.69	15.38	100
	19.72	51.72	66.67	36.88
Total	50.35	41.13	8.51	100
	100	100	100	100

Source: Primary Data, 2019.

Note: Values in the first row reflects row wise percent and values in the second row reflect the column wise percent.

Adequacy

Availability of sufficient quantity of drinking water is considered important for maintaining health and hygiene requirements of the households (NSSO, 2010). The information on adequacy of drinking water is also collected in the survey. The informant was asked a question on sufficiency of drinking water with respect to the first major source. All bore-well users get sufficient water and about 85 percent piped water users report sufficiency of water (Table 5.3). It is seen that majority of public tap, hand-pump and community owned bore-well users reports insufficiency of water. All of these sources are public sources. The reason may be distance to water sources as these sources are not located within premises and used by everyone who wants to use it. So, these users have to spend time for water collection (walking & waiting). The volume of the water consumed is affected by the distance to the water source from the house (Tiwari, 2017). The data also reveal that majority of non-slum households get sufficient water for their daily needs while 36 percent households of notified slum and merely 5 percent households of non-notified slum obtain sufficient water.

Table 5.3: Source-wise Sufficiency of Drinking Water

Source	Yes	No	Total
Piped Water	85.39 69.09	14.61 10	100 37.08
Public Tap	1.92 0.91	98.08 39.23	100 21.67
Bore-well	100 28.18	00 00	100 12.92
Hand-pump	11.11 0.91	88.89 6.15	100 3.75
Community owned Bore-well	1.72 0.91	98.28 43.85	100 24.17
Others	00 00	100 0.77	100 0.42
Total	45.83 100	54.17 100	100 100

Source: Primary Data, 2019.
Note: Values in the first row reflects row wise percent and values in the second row reflect the column wise percent.

5.3.1 Quality of Drinking Water

Drinking water availability to households from their principal sources cause varying quality of the water. The distribution of households by various categories of quality, i.e., look, smell etc. for each principal source of drinking water is as per the perception of the respondent. About 60 percent sampled households reported drinking water served by their principal source contamination free, while 29 percent households reported dissatisfaction and 11 percent households reported neutral regarding the quality of drinking water available to them (Table 5.4). However, this proportion varied over the principal sources. Bore-well is reported as the safest drinking water source while satisfaction about quality is the lowest for households served public tap. About 29 percent households find their water abnormal in colour and 8 percent households find abnormal look sometimes. The source-wise analysis shows that about 54 percent households face sand and mud with drinking water through public tap. About one-fourth sampled households report foul smell and it is clearly evident that the households dependent on public tap are most affected by the above mentioned problem.

Table 5.4: Perception about Quality of Drinking Water by Source (in percent)

Quality of Drinking Water	Piped Water	Public Tap	Bore-well	Community owned Bore-well	Hand-pump	Others	Average
Contamination of Water							
Yes	70.45	19.23	87.1	44.44	65.52	100	59.41
No	25	59.62	00	00	27.59	00	28.87
Can't say	4.55	21.15	12.9	55.56	6.9	00	11.72
Colour of Water							
Clean	61.8	38.46	96.77	77.78	67.24	100	63.63
Cloudy/dirty	30.34	53.85	3.23	11.11	22.41	00	29.17
Sometimes clean / sometimes dirty	7.87	7.69	00	11.11	10.34	00	7.5
Smell of Water							
No smell	65.17	50	87.1	66.67	51.72	100	61.67
Foul smell	24.72	38.46	9.68	22.22	34.48	00	27.92
Can't say	10.11	11.54	3.23	11.11	13.79	00	10.42

Source: Primary Data, 2019.
Note: Values in the first row reflects row wise percent and values in the second row reflect the column wise percent.

Different causes for quality being unsatisfactory are reported during the survey. While comparing various attributes of water quality between different types of households, the dwellers in the non-notified slums are in poor condition as all the parameters showing inferior quality of water condition compared to those of other types of households (Table 5.5).

Table 5.5: Perception about Quality of Drinking Water by Different Types of Households (in percent)

Quality of Drinking Water	Non-slum Households	Notified Slum Households	Non-notified Slum Households	Total Sampled Households
Contamination of Water				
Yes	81.25	63.29	33.75	59.41
No	13.75	20.25	52.5	28.87
Can't say	5	16.46	13.75	11.72
Colour of Water				
Clean	77.5	65	47.5	63.33
Cloudy/dirty	15	30	42.5	29.17
Sometimes clean / sometimes dirty	7.50	5	10	7.5
Smell of Water				
No smell	83.75	52.5	48.75	61.67
Foul smell	13.75	35	35	27.92
Can't say	2.5	12.5	12.5	10.42

Source: Primary Data, 2019.

Note: Values in the first row reflects row wise percent and values in the second row reflect the column wise percent.

5.4 Coping Strategies

In general terms, 'coping' means to deal with and attempt to overcome problems and difficulties. In this study, coping strategies refer to the specific efforts of households to unreliable water supply. The main coping strategy of developed countries is treatment of water while in the case of developing countries, households have to spend time traveling and waiting for water due to intermittent and poor quality of existing water supplies (Amit & Sasidharan, 2019). Pattanayak et al. (2005) and Zerah (2000) consider collection costs in their studies. Thus, coping strategies include investments in bore-wells, booster pumps, water storage, purchase of water (bottled water/vendor supply), use of filters, aqua-guards and boiling of water (Misra & Goldar, 2008; Zerah & Jaglin, 2011) while common coping strategies include drilling wells, storing water, and collecting water from alternative sources (Majuru et al., 2016).

There are five principal sources of drinking water, such as municipal supply, bore-well, public tap, hand-pump, community owned bore-wells in the study area. Whereas non-slum households depend on municipal supply and bore-well, almost slum dwellers obtain their drinking water from public tap, community owned bore-well and hand-pump. As per field data, there is unreliable and unsafe water supply in Lucknow. Households have to face water shortage, irregular supply with low pressure and various water quality problems. However,

slum households suffer more with these problems. To combat this situation, households adopt various coping strategies; collecting, pumping, storing, treating and purchasing. The study also finds that households often engage in multiple coping strategies.

Only 43 percent sampled households have drinking water source within dwelling while another 20 percent households have this facility within premises and rest of the households have to go far to collect their water. Household members have to spend time walking to and waiting at the water source. Women and girls bear the primary burden of water collection. Source-wise analysis shows that average collection time is the highest for community owned bore-wells among all sources. More than half non-notified slum dwellers depend on it. Mean collection time per day is 48 minutes for community owned bore-well, 35 minutes for public tap and it is 24 minutes for handpump. A study also finds that collection time depends on type of sources as handpumps and public taps have low capital and maintenance costs, but water must still be carried from the source to the home (Whittington et al.,1990). Mean collection time of total households is 38 minutes per day and 1145 minutes per month. Collection time also depends on type of households. In this study, three types of households, i.e., non-slum households, notified slums and non-notified slums have been taken. It is observed that there is no collection time for non-slum households while average collection time per day of notified slum dwellers is 31 minutes and it is 43 minutes for non-notified slum dwellers (Table 5.6).

Table 5.6: Household-wise Number of Trips per Day and extent of Collection Time per Day and per Month

Type of Households	Mean Trips	Mean Collection Time per day (in mins)	Mean Collection Time per Month (in mins)
Notified	6.04	31.35	940.36
Non-notified	6.1	42.89	1286.63
Total	6.07	38.19	1145.56

Source: Field Data, 2019.

One of the main coping strategy to enhance water quantity is drilling tube wells or usage of booster pumps by piped water users. In this study, thirty one households use tube well for drinking purpose; out of which 26 households have private tube wells while 5 households live in rented house. Eighty nine households use municipal supply to obtain their drinking water; out of which fifty one households use booster pumps for storing water into overhead tanks. 86 percent non-slum households use it while 10 percent notified slum dwellers and no

non-notified slum dwellers use this coping strategy. Average pumping time is 42 minutes per day and it is higher for piped water users than tube well users (Table 5.7).

Table 5.7: Source-wise Number of Households and Mean Pumping Time

Source	No. of Households use Pumps	Total No. of Households	Mean Pumping Time (in Mins)
Piped Water	51	89	46.55
Tube well	26	31	32.81
Total	77	120	41.91

Source: Field Data, 2019.

The households use different types of storage devices, such as bucket, ground tank and overhead tank. Almost, 34 percent households use overhead tanks while 20 percent households use ground tanks (Table 5.8). The tank size varies from 200 litres to over 1000 litres. Overhead water tank is the main form of home storage for non-slum households. Water is also stored in small containers such as buckets. Almost non-notified slum dwellers use buckets for storing water. However, storage process for such smaller containers can be tedious as overhead tanks are filled up automatically by use of tube wells or booster pumps (Majuru et al., 2016).

Table 5.8: Distribution of Households by Type of Storage Tanks (in percent)

Type of Households	Bucket	Ground Tank	Overhead Tank
Non-slum	2.5	8.75	88.75
	1.79	14.89	87.65
Notified	41.25	46.25	12.5
	29.46	78.72	12.35
Non-notified	96.25	3.75	00
	68.75	6.38	00
Total	46.67	19.58	33.75
	100	100	100

Source: Field Data, 2019.

Note: Values in the first row reflects row wise percent and values in the second row reflect the column wise percent.

Majority of the sampled households perceive water quality not safe for drinking. Only 27.5 percent households report quality of water satisfactory while 47.5 percent households are not satisfied another 25 percent households are neutral about quality of water. Only one-fourth of the sampled households use water purification method. Three-fourth of total households do not use any type of purification method. The main reason for not purifying water among slum dwellers is budget constraint (Table 5.9). One of the main reasons for not purifying water among non-slum households is use of bottled water. Filtration (either ceramic or electronic) is the most common method of household water treatment. 14 households use water filter and 44 households use electronic purifier while only 2 households use boiling method.

Table 5.9: Distribution of Households by Reasons for not Treating Drinking Water (in percent)

Type of Households	Not enough Money	Water is good enough	Use Bottled Water	Others	Total
Non-slum	14.29	52.38	33.33	00	100
	2.61	28.95	100	00	11.67
Notified	67.09	21.52	00	11.39	100
	46.09	44.74	00	45	43.89
Non-notified	73.75	12.5	00	13.75	100
	51.3	26.32	00	55	44.44
Total	63.89	21.11	3.89	11.11	100
	100	100	100	100	100

Source: Estimated from Field Survey Data, 2019.

Note: Values in the first row reflects row wise percent and values in the second row reflect the column wise percent.

Purchasing of can water is also reported in the study. Only 7 households buy can water. None of the slum dwellers purchase can water as it is very expensive.

5.4.1 Coping Cost

The adoption of any coping strategy carries costs. Coping cost can be classified into direct cost and indirect cost; capital cost and recurring cost. Direct coping cost includes cost of purchasing water, installing storage tanks, purifier and digging wells while indirect coping cost includes opportunity costs of time spent collecting water. In terms of second classification, capital cost includes investment in borewells, water filters and overhead reservoirs while recurring cost includes energy charges for pumps, expenses on filters for water purification and fuel for boiling. Five types of coping cost are revealed in the survey.

Collection Cost

The opportunity cost of time spent for water collection has been estimated for households that collect water from public taps, handpumps or community owned borewells, which include households mostly from non-notified slums (99 percent) and notified slums (69 percent). The maximum collection time is 3000 minutes per month in the study. We estimated the costs of time spent collecting water by multiplying the time with the hourly wage rate. For this study, we have used 50 percent of the minimum hourly wage rates mandated by the Government of Uttar Pradesh (mean hourly wage rate was Rs. 49.16 in 2018). The 50 percent estimate is similar to fractions used in estimating time costs in travel mode choice and recreation demand models (Whittington et al., 1990; Pattanayak et al., 2005). The average collection cost is Rs. 469.30. It is the highest for community owned borewells among all sources.

Pumping Cost

Households that used different types of pumps are asked about the costs of putting it. The costs differed across types of pumping and drawing equipment used. About 13 percent households have invested in borewells, with an average per household investment of Rs. 23,461. About two-third municipal water users have installed motors directly onto municipal water connections to boost the water pressure so that storage tanks can fill up, with an average investment per household of Rs. 5,098. These capital costs are amortized into monthly costs based on a 15 year lifespan of pumps (Pattanayak et al., 2005; Amit & Sasidharan, 2019). One of the major items of pumping cost is energy charges on borewells and booster pumps. Power consumption mainly depends on the capacity of the pump.

We assume that municipal water users use booster pump of 0.5 HP capacity and borewell users use submersible pump of 1 HP capacity. 1 HP = 746 Watts = 0.746 kwh (kilo watt per hour). If mean pumping time of a borewell user is 40 minutes per day then electricity consumption per day = 0.746 * 40/60 = 0.497 unit. Per unit price in Uttar Pradesh was Rs. 5.50 in 2018. So, we can estimate per month energy cost by multiplying per day energy consumption * per unit price * 30. For piped water users, 0.746/2 = 0.373 kwh is multiplied by per month energy consumption and per unit energy price. As per these calculations, the average monthly expenditure on electricity is about Rs. 45 for municipal water users and Rs. 67 for borewell users. The mean pumping cost is Rs. 161 per month and it includes monthly capital cost on pumps and monthly pumping cost. The average pumping cost for the municipal water users and borewell users is Rs. 118 and Rs. 258 per month, respectively.

Storage Cost

The households are also asked about the cost of the storage tank and these costs are amortized to monthly costs, assuming 20 years lifespan. The costs differed across types of storage tanks used. About 88 percent non-slum households have invested in overhead tanks, with an average per household investment of Rs. 1,508. About 46 percent notified slum dwellers have invested in ground tanks, with an average investment per household of Rs. 505. The mean storage cost is Rs. 3 per month.

Treatment Cost

About 18 percent sampled households have invested in electronic purifiers, with an average per household investment of Rs. 7,420 and about 6 percent households have invested in simple water purifiers, with an average per household investment of Rs. 2,536. These capital costs on electronic purifiers are amortized into monthly costs, assuming 10 years lifespan (Amit & Sasidharan, 2019) and capital costs on simple purifiers are amortized into monthly costs, assuming 5 years lifespan (Pattanayak et al., 2005). One of the major components of treatment cost is repair and maintenance of filters. The average monthly expenditure on repair and maintenance is about Rs. 104 for simple water purifier and Rs. 230 for electronic purifier. The average monthly cost of filtration is Rs. 249. The average filtration cost for simple water purifier and electronic purifier is Rs. 146 and Rs. 290 per month, respectively.

Purchase Cost

Only 3 percent households purchase can water. A 20 litre can of water costs approximately Rs. 70 in Lucknow. The average monthly purchase cost is Rs. 220.

5.4.2 Mean Coping Cost of Sampled Households

Source-wise Mean of Coping Cost

The average coping cost for sampled households is about Rs. 389 per month. Source affects coping cost significantly. It is the highest for community owned bore-well users and lowest for piped water users among all sources (Table 5.10). There is considerable variation in various types of coping costs among all sources. For instance, collection costs are higher for community owned bore-well users and public tap users while pumping costs and treatment costs are higher for bore-well users and piped water users. It is clearly revealed that community owned bore-well users and public tap users do not purify their water and they have not to bear any treatment cost. One reason may be their budget constraint.

Table 5.10: Source-wise Average Coping Cost (in Rs.)

Source	Collection cost	Pumping cost	Treatment cost	Storage cost	Purchase cost	Average coping cost
Piped Water	248.87	118.12	238.42	4.75	210	248.13
Public Tap	432.04	00	00	1.00	00	433.04
Bore-well	00	258.16	290.28	5.91	224	370.93
Hand-pump	299.06	7.92	00	1.18	00	302.00
Community owned Bore-well	589.92	00	00	1.11	00	591.03
Average coping cost	469.30	161.42	248.80	3.07	220	388.80

Source: Author's calculations.

Household-wise Mean of Coping Cost

A considerable variation can be seen in coping costs across different types of households in Lucknow. The mean coping cost of non-slum household is about Rs. 357 while it is Rs. 282 for notified slum households and Rs. 528 for non-notified slum households (Table 5.11). Further, it is also shown that pumping cost is highest for non-slum households, on the other hand, treatment cost is highest for notified slum households and collection cost is highest for non-notified slum households. Therefore, it is clear that non-slum households spend more on

pumping, storage and purchasing of can water while slum dwellers spend more on water collection. A study also finds that the poorest sections of society suffer most from the impacts of unreliable water supplies and rely on coping strategies that are labour and time-intensive (Majuru et al., 2016).

Table 5.11: Household-wise Average Coping Cost (in Rs.)

Type of Cost	Non-slum Households	Notified Slum	Non-notified Slum	All Households
Collection cost	00	385.24	527.09	469.30
Pumping cost	171.92	88.97	00	161.42
Treatment cost	248.07	291.67	00	248.80
Storage cost	6.20	2.10	0.90	3.07
Purchase cost	220	00	00	220
Average coping cost	356.68	281.72	527.99	388.80

Source: Author's calculations.

5.5 Empirical Analysis

Multiple Regression Analysis by using Ordinary Least Square method has been used to determine the factors correlated with the coping costs. It is assumed that the coping strategies of the households depend on the income, education, age, family size (Pattanayak et al., 2005). Further, a recent study also examines the effect of type of sanitation, piped connection and household's perception about water quality on total coping costs (Amit & Sasidharan, 2019) while another study includes interaction dummy of household size with income decile in his regression model (Cook et al., 2016). In addition, we also examine the effect of types of drinking water sources on total coping costs as coping cost is also affected by water source at a great extent.

The ANCOVA model has been used to study the impact of various explanatory variables on total coping costs. It examines the impact of family size (size), education of the household head (EDU), per capita income (PCI), drinking water sources and household's perception about water quality (QL) on total coping costs. The functional form of the regression model is as follows.

$$TCC = b_0 + b_1Size + b_2EDU + b_3PCI + b_4CBW + b_5HP + b_6BW + b_7PT + b_8QL + U_i$$

Where TCC is the total coping cost; b_0 is the intercept; b_1, b_2, b_3, b_4, b_5, b_6, b_7 and b_8 are the coefficients associated with size, EDU, PCI, CBW, HP, BW, PT and QL, respectively and U_I is the error term.

There is a positive and significant relationship between household size and per capita income with total coping costs. The regression results suggest that as household size goes up by one person, on average, total coping costs goes up by about Rs. 56 keeping other variables remains constant (Table 5.12). However, the coefficient of per capita income is very small, but it is positive and significant which implies that the higher income households tend to spend more on various coping strategies such as storing, treatment etc. as they have more financial resources. This is consistent with the result of other studies (Pattanayak et al., 2005, Cook et al., 2016 & Amit & Sasidharan, 2019).

There are five primary sources of drinking water in the study area, viz., municipal piped water, bore-well, community bore-well, public tap and hand pump. To find out if the total coping costs differ among the five drinking water sources in Lucknow significantly, we have included dummy variable of each primary source in the regression model. Municipal piped water is the base category. The result shows that households who use municipal piped water have to spend least coping cost as compared to other sources as all dummies of sources have positive and significant slope coefficients. As per regression results, the mean total coping cost for community owned bore-well is higher by Rs. 300 as compared to municipal piped water when other things remain constant. Further, the average total coping cost for hand pump and public tap is higher by Rs. 80 and Rs. 134 as compared to municipal piped water when other things remain constant.

Coping cost is also expected to vary with household's perception about water quality. The results reveal that household's perception about water quality affects coping cost as those households that perceive quality of available water as good have lower coping costs. Therefore, a negative association exists between water quality and expenditure incurred on coping cost. It implies that the households who perceive available water as good spend less on water quality improvement mechanisms such as water purifier.

The regression result suggests that coping costs are higher for households that use community sources of water such as community owned bore-wells, public taps and hand pumps. Coping costs are also higher for larger families. Overall model statistics such as the

predictive power and statistical significance are presented in the bottom of the table. The model is statistically significant and the overall explanatory power is 51.76 percent.

Table 5.12: Determinants of Coping Costs of Drinking Water in the Surveyed Households

Variables	Description of Variables	Coefficient	T value	P value
Size	Size of the family	56.36	8.78	0.000
EDU	Education of the household head	0.70	0.26	0.797
PCI	Per capita income	0.012	6.04	0.000
CBW	Community bore-well =1, others =0	423.91	11.18	0.000
HP	Handpump =1, others =0	204.98	3.15	0.002
BW	Bore-well =1, others =0	106.06	2.77	0.006
PT	Public tap = 1, others =0	258.34	7.03	0.000
QL	Good =1, others =0	- 48.84	- 1.89	0.060
Constant		- 124.27	- 2.60	0.010
	Log Likelihood			
	R^2	51.76		
	F-Statistics	30.99***		

Source: Computed by Primary Data.

5.6 Summary & Conclusions

Safely managed drinking water facility includes water accessibility, water quality, sufficiency and reliability as per modified JMP classification. But in Lucknow, municipal water is not available for 24 hours a day, a majority of households report that water is available twice a day for only 4 to 6 hours. Water quality is also not found up to the mark in terms of taste and smell

and about 54 percent households report insufficiency of water. In this context it can be said that Lucknow Jal Nigam does not provide safely managed drinking water.

This chapter identifies the coping strategies and estimates associated costs for erratic, unsafe, and inadequate water supply in the city of Lucknow, Uttar Pradesh. Taking slum and non-slum households together, the average coping cost borne by sampled households is about Rs. 389 per month. It is highest for non-notified slum dwellers, i.e., Rs. 528. The regression results show that drinking water source is the main determinant of coping cost and different types of water source users have to bear different types of costs. Family size and income is positively related to coping costs. These results are consistent with the results from earlier studies on coping studies like Amit & Sasidharan (2019), Cook et al. (2016) and Pattanayak et al. (2005).

The analysis clearly reflects that consumers in Lucknow especially slum dwellers are bearing huge costs to cope with the inadequacies of water supply services currently being provided. Non-notified slum dwellers have to bear highest coping cost which is mainly due to collection costs (time costs in traveling and queuing for collecting water). Therefore, the government should provide piped connections to non-notified slum households. Lucknow Jal Nigam should also take efforts to provide good quality and reliable water supply to its citizens. When water comes from improved and more accessible sources, people spend less time and effort physically for collecting it, so they can be productive in other ways. Better water sources also mean reduction in the adverse impacts on waterborne diseases (Tiwari & Nayak, 2017) and less expenditure on health.

CHAPTER - 6

Valuation of Health Cost in Lucknow

6.0 Introduction

Human health depends on safe and sufficient amount of water, adequate sanitation and hygienic conditions. Access to safe drinking water and sanitation is a condition for a healthy society and a prerequisite for human development. It is already evidenced by various studies that an improved facility of drinking water and sanitation can reduce health cost of a state significantly (WSP, 2011; Satapathy, 2014; Ghosh, 2017) and a main determinant of nutrition (Jose & Navaneetham, 2010; Dev, 2019). Numerous empirical works have reflected on the issues subjects of waterborne diseases and its impact on human beings. The contamination of drinking water by pathogens causing diarrhoeal diseases is the most important aspect of drinking water quality. The problem arises as a consequence of contamination of water by faecal matter, particularly human faecal matter, containing pathogenic organisms (Fawell & Nieuwenhuijsen, 2003). Polluted and contaminated water can cause water-borne diseases like Cholera, Typhoid, Malaria and Dysentery. Unsafe water, sanitation and unhygienic conditions are also important determinants in a number of additional diseases like schistosomiasis, trachoma, hookworm, yellow fever, filariasis, dengue, hepatitis A, hepatitis E, etc. (Satapathy, 2014). In India, unsafe water and sanitation is the seventh leading risk responsible for disease burden. It contributes 4.6 percent of the total disease burden mainly through diarrhoeal diseases and other infections. Due to unsafe drinking water and sanitation, the per person disease burden in India is 40 times higher than China and 12 times higher than in Sri Lanka (ICMR, PHFI & IHME, 2017). Each year, an estimated 180 million person-workdays are lost due to the incidence of water-borne disease. This is to cost to the Indian economy of Rs. 12 billion (Chaplin, 2011).

6.1 Review of Literature

Many studies observed the poor are more susceptible to ill-health than the non-poor, due to their lack of access to adequate safe water, malnutrition and unhealthy living conditions (Johnstone, 1997; Hussain et al., 2003; Phansalkar, 2007; Jha, 2010). Mazumdar, et al. (2000) found that arsenic in drinking water resulted in cough, chest sounds in the lungs and shortness of breath in West Bengal.

Pushpangadan (2006) examined by using Data Envelopment Analysis (DEA) for the estimation of the well-being from drinking water using ‘commodities and capabilities’ approach in his macro level study and concluded that Punjab has the least efficiency while Kerala and Orissa as the Pareto-efficient states. He found that water-borne diseases can be

avoided if public policy promotes hygiene education in water handling practices and encourages treatment of water before consumption. Health benefits of improved water supply and sanitation also include an increased economic well-being at the household level, mainly through saving large amounts of people's time and energy. Such saved time and energy can be used in economically productive or educational activities (Mavalankar, & Shankar, 2004).

People living in slums are much suffered by waterborne diseases due to water contamination. Due to rising population, the numbers of slum dwellers have been increasing in Indian cities. While slums differ in size and other characteristics from country to country, most of them lack reliable sanitation services, supply of clean water, reliable electricity, timely law enforcement and other basic services. Diseases that have been reported in slums include cholera, measles, malaria, dengue, typhoid, drug resistant tuberculosis, and other epidemics. Studies focus on children's health in slums address that cholera and diarrhoea are especially common among young children (Basappa, 2015). A study explains intermittent water supply is the main cause of contaminated water and water-related diseases. During non-supply hours, the pressure in the pipes drops and the water could be polluted by waste water through the faulty joints while during continuous water supply, the pipes are under positive pressure and entry of contaminations into pipes is restricted. So, continuous water supply systems can reduce contamination levels and water-related diseases (Satapathy, 2014).

The empirical study of slum and non-slum areas of Ahmedabad city, analyses the role of institutions in facilitating the breeding of waterborne diseases. The study reveals the importance of religion, household vulnerability; access to good quality water and the types of sources are the main determinants of water-borne diseases (Saravanan et. al, 2015). A study based on primary data of eight districts in three states; Haryana, Gujarat and Uttar Pradesh explored the link between access to basic amenities and morbidity in general, and communicable diseases in particular. The study found causal linkage between access to basic amenities and its impact on preventable diseases (Chowdhury, et al., 2017).

6.2 Health Status of Study Area

Illness is strongly and negatively associated with wellbeing, and that better health outcomes are associated with higher levels of happiness. Health is a state of complete physical, mental and social wellbeing, and not merely the absence of disease or infirmity (Isunju, et al., 2011). Health status of the society is probably the best measure of its social well-being. There are various objective and subjective measures of health status which include measures on

morbidity, mortality, disability and quality of life. Self-reported morbidity (SRM) is one of the common methods used in large nationwide surveys to assess the health status of a population (Prinja et al., 2015).

About 11 percent of people (135 people from total 1178 population in 240 households) are fallen sick during last one year due to various diseases. This study has major focus on water-borne diseases and sanitation related diseases. So, the diseases have been classified into water-borne diseases and others**.** Waterborne diseases are caused by pathogenic micro-organisms, like viruses and bacteria, those are ingested through contaminated water. Diarrhoea, cholera, typhoid, dysentery and malaria, eye and skin infection and disease related to ear, nose and throat are waterborne diseases. These diseases can be controlled by appropriate water treatment methods and hygiene practices. In the present study, water-borne diseases primarily exist as slum dwellers. The rest diseases are being categorised as 'other' which includes asthma, fever other than malaria, diabetes, cardiac disease, gastro-intestinal disease and others.

The diseases have also been classified into acute, semi-chronic and chronic according to duration of diseases. Acute illness is defined as a disease that has an abrupt onset and is generally short-lived while chronic illness is a human health condition that is persistent and lasts longer than usual. In most cases, it cannot be cured completely (GOI, 2013c). In the present study, acute disease refers to duration of illness less than 15 days while more than 15 days and less than six months duration of illness is classified as semi-chronic disease and more than six months duration is classified as chronic disease. Only 8 chronic diseases are reported by sampled households, so we have combined semi-chronic and chronic disease for analysis.

The number of cases is higher for acute illness as compared to semi-chronic and chronic illness for all types of households. It is observed that non-slum households report lowest for all types of illness among all households, however, scenario in both types of slums is more or less same. The number of total cases of acute illness for non-slum households, notified and non-notified slums are 20, 34 and 40 respectively while the corresponding figures for semi-chronic and chronic illness are 11, 20 and 10 respectively (Table 6.1). The reason may be high population density and overcrowding in slums. The potential for spread of diseases in slums is usually much greater than in less crowded neighbourhoods (Isunju, et al., 2011).

There is found 91 cases of water-borne diseases while 44 cases of other type of diseases. The number of cases of acute water-borne diseases is almost double of other diseases

in the study area (62 and 32 respectively). On the other hand, semi-chronic and chronic water-borne diseases is more than half of the acute diseases (29 and 62 simultaneously). Therefore, it can be said water-borne disease is prevalent in slum areas of Lucknow. The scenario in both types of slums is almost same. 54 persons in notified slums and 50 persons in non-notified slums are fallen sick during last one year due to various diseases. However, the number of water-borne diseases and other diseases is higher in non-notified slums for acute illness (28 and 12 respectively), whereas the number of both type of diseases is higher in notified slum than that of non-notified slums for semi-chronic and chronic illness.

Table 6.1: Household-wise Various Types of Diseases in Lucknow (in percent)

Disease	Type of Households	Water-borne Disease	Other Disease	Total No. of Disease
Acute	Non-slum	10 (50) (16.13)	10 (50) (31.25)	20 (100) (21.28)
	Notified Slum	24 (70.59) (38.71)	10 (29.41) (31.25)	34 (100) (36.17)
	Non-notified Slum	28 (70) (45.16)	12 (30) (37.5)	40 (100) (42.55)
	Total	62 (65.96) (100)	32 (34.04) (100)	94 (100) (100)
Semi-chronic & Chronic	Non-slum	7 (80) (24.14)	4 (20) (33.33)	11 (100) (26.83)
	Notified Slum	15 (75) (51.72)	5 (25) (41.67)	20 (100) (48.78)
	Non-notified Slum	7 (70) (24.14)	3 (30) (25)	10 (100) (24.39)
	Total	29 (70.73) (100)	12 (29.27) (100)	41 (100) (100)

Source: Primary Data

Note: Values in the first row reflects row wise percent and values in the second row reflect the column wise percent.

As age is an important factor in health related studies, we have classified total sampled population according to their age into four groups. First group belongs to the children under 5 years as it is found in various studies that waterborne diseases especially diarrhoea is one of the leading causes of death among children under 5 years old (Paul, 2020). Under this age group in study area, 15 percent of the total disease burden across all ages exist. It is further observed that there is large scale variation in getting affected by various types of diseases across the different age groups by water-borne diseases. The prevalent among population above 15 years have suffered more with other types of diseases such as life style diseases, i.e., diabetes, cardiac disease etc. About fifty percent out of total cases of water-borne diseases are found in children below 15 years of age (Table 6.2). Whereas children below 15 years of age are more exposed to acute illness, the adults are more prone to chronic diseases. It is observed that non-slum households have lowest for all types of illness among all age groups as compared to notified and non-notified slums (Appendix 6.1 & 6.2).

Table 6.2: Age-wise Various Types of Diseases in Lucknow (in percent)

Age Group	Water-borne	Other	Total
0 – 5 years	16 (80) (17.58)	4 (20) (9.09)	20 (100) (14.81)
6 - 15 years	29 (76.32) (31.87)	9 (23.68) (20.45)	38 (100) (28.15)
16 – 60 years	37 (60.66) (40.66)	24 (39.34) (54.55)	61 (100) (45.19)
Above 60	9 (56.25) (9.89)	7 (43.75) (15.91)	16 (100) (11.85)
Total	91 (67.41) (100)	44 (32.59) (100)	135 (100) (100)

Source: Primary Data

Note: Values in the first row reflects row wise percent and values in the second row reflect the column wise percent.

6.2.1 Diseases Prevalent in the Study Area

This study is based on self-reported morbidities reported by respondents in the study area during the survey period. Diarrhoea is one of them. Diarrhoea is a symptom rather than a disease. There are several illnesses that can cause diarrhoea but mostly it signals a gastrointestinal infection (Fuentes et al., 2006). Diarrhoea is caused primarily by infectious pathogens (including viruses, bacteria, protozoa, and parasites) that are excreted in the faeces of infected humans. This infected faecal matter can then be transported to the digestive tract of other uninfected humans via the hands, water, food, or insects (Buttenheim, 2008). Acute diarrhoea causes life-threatening dehydration, while chronic diarrhoea can compromise growth and development by preventing the absorption of nutrients. The households have informed about 29 cases of diarrhoea and all cases are acute (Table 6.3). The highest reported cases of diarrhoea are from non-notified slums. 59 percent of total cases are found in non-notified slums while 38 percent cases are found in notified slums. An estimated 94 percent of the diarrhoeal diseases are attributable to the environment and associated with risk factors such as unsafe drinking water, lack of sanitation and poor hygiene (Pruss-Ustun and Corvalan, 2006). It disproportionately affects poor households, because these households have relatively little access to sanitary toilets and improved drinking water facility (Paul, 2020).

Cholera is an acute diarrhoeal disease caused by the / of food or water contaminated with the bacterium Vibrio cholera. This disease is endemic in regions with poor socioeconomic conditions, rudimentary sanitary systems, absence of wastewater treatment and where public hygiene and safe drinking water is lacking (World Water Assessment Programme, 2012). Due to these reasons, all cases of cholera is found in slum areas. Like diarrhoea and cholera, dysentery is also spread through contaminated food or water. In the study area, total 7 percent among all the illness are reported as affected by dysentery and 80 percent among them are reported in slums. All cases are acute in nature.

Typhoid fever is not a diarrhoeal disease, but it is also associated with poor quality of water supply, sanitation and hygiene. The disease is mostly acute in nature with prolonged fever, headache and nausea. In the study area, 10 percent from all the types of illness are reported as typhoid. Within the typhoid, 50 percent of them are semi-chronic in nature, whereas rest 50 percent cases are acute in nature. Like all other diseases, more typhoid cases are found in slum areas. Further, Jaundice is a symptom caused by hepatitis virus. The affected person's skin turns yellow or pale that happens when the body does not process bilirubin properly. This may be due to a problem in the liver. It is also transmitted through faecal contaminated food

and water like other water borne diseases. 4 percent of the total cases are reported as jaundice, and 67 percent of them were semi- chronic and chronic in nature. 83 percent jaundice cases are found in slums.

Dengue is an acute infectious disease caused by the dengue virus and transmitted by the bite of infected mosquitoes. Dengue ranks as the most important mosquito borne viral disease in the world. Like Dengue, Malaria is also a common vector borne disease which is spread out due to mosquitoes. These diseases are also linked to water resource development and management. They can be reduced by eliminating small water collectors and solid waste around the home and in the community. In the study area, total 8 percent among all the illness are reported as Dengue and Malaria. 70 percent of reported cases are found in slum areas as they are easily exposed to mosquitoes due to inadequate drainage and sewerage systems. The households have informed that 7 out of 8 cases of dengue are semi-chronic.

Tuberculosis (TB) is another widespread disease suffered by the slum dwellers. TB is a serious infectious disease that mainly affects the lungs. The bacteria that cause tuberculosis is 'Bacillus Mycobacterium tuberculosis' which spreads from person to person through tiny droplets released into the air via coughs and sneezes. India has an exceptionally high burden of tuberculosis, contributing the largest number of new cases annually of any country in the world (ICMR, PHFI & IHME, 2017). There are 6 TB cases accounted in the survey and all the tuberculosis cases are being reported in notified and non-notified slums.

Skin and eye infection is also related to poor hygiene and inadequate water supplies. Once enough water is available and used for personal and domestic hygiene, the prevalence of these diseases diminishes. Therefore, these diseases are often classified as water-washed diseases. The households have informed about 12 cases of skin and eye infection and all cases are acute. Besides diarrhoea, fever is another highest reported disease in the study area. 28 cases of fever are reported which are about 21 percent among all reported diseases. Most of them are acute and only 2 case of fever is chronic in nature.

Therefore, it can be said that water borne diseases are more prevalent in the study area and slum dwellers are more suffered with water-borne diseases due to inadequacy of safe drinking water and sanitation facilities in slum areas. Poor drainage, lack of solid waste disposal and inadequate wastewater treatment also contribute to the spread of water related diseases in the slum areas (Nayak, 2019).

Table 6.3: Disease wise extent of Illness in Lucknow

Disease	Acute	Percent to Total	Chronic	Percent to Total	Total	Percent to Total
Diarrhoea	29	29.29	0	00	29	21.48
Dysentery	10	10.1	0	00	10	7.41
Typhoid	3	3.03	11	39.29	14	10.37
Cholera	4	4.04	0	00	4	2.96
Jaundice	2	2.02	4	14.29	6	4.44
Dengue	1	1.01	7	25	8	5.93
Pneumonia	0	00	1	3.57	1	0.74
Skin & Eye infection	12	12.12	0	00	12	8.89
Throat infection	1	1.01	0	00	1	0.74
Malaria	2	2.02	1	3.57	3	2.22
Tuberculosis	0	00	6	21.43	6	4.44
Fever	26	26.26	2	7.14	28	20.74
Respiratory & Lungs infection	1	1.01	3	10.71	4	2.96
Other	3	3.03	6	21.43	9	6.67
Total	99	100	28	100s	135	100

Source: Primary Data.

6.3 Type of Healthcare Services

Availability, accessibility and affordability of health services affect population health to a great extent. Four types of healthcare sources are found in the study area, such as public, private, trust hospital, unregistered local practitioner (hakeem). About 59 percent households say that they have often used private healthcare source, 8 percent go to the trust hospital while 26 percent households use public healthcare services (Table 6.4). About 4 percent households use public and private both types of healthcare services. There is large scale variation in use of healthcare services across households in intra and inter slums level. 84 percent non-slum

households go to private hospitals while about 45 percent slum households use (avail) private healthcare services. Only 10 percent non-slum households use public healthcare services, while about 34 percent slum dwellers use it. Rickshaw Calony slum among non-notified slums and Behasa slum among notified slums have the highest households visiting public hospitals for treatment. While slum dwellers of Buroolia slum among notified slums and Cheekan wali Gali slum among non-notified slums prefer most to go to private clinics. 70 percent Slum dwellers of Shahnajaf Imambara slum seek treatment in trust hospital. Thus, it is found that the households of Lucknow mainly depend on private healthcare services. A recent study also reveals that 86 percent of the population in Uttar Pradesh avails services from the private health sector (Ranganadham & Yadav, 2021).

Table 6.4: Various Types of Healthcare Services across Households in Lucknow (in percent)

Type of Households	Hakeem	Private	Public & Private	Public	Trust Hospital	None of these
Non-slum	00	83.75	3.75	10.0	2.5	00
	00	47.52	33.33	12.7	10.53	00
Notified Slum	2.5	47.5	5.0	31.25	12.5	1.25
	28.57	26.95	44.44	39.68	52.63	100
Non-notified Slum	6.25	45.0	2.5	37.5	8.75	00
	71.43	25.53	22.22	47.62	36.84	00
Total	2.92	58.75	3.75	26.25	7.92	0.42
	100	100	100	100	100	100

Source: Primary Data

Note: Values in the first row reflects row wise percent and values in the second row reflect the column wise percent.

In India, there is higher dependency on the private healthcare sector. Only 26 percent households seek treatment in public healthcare services in the study area. A study also found lower level of utilisation of public healthcare services in Uttar Pradesh than the all-India public levels due to poor health services (Baru et al., 2010). About 70 percent sampled households do not go to the government hospitals due to the weakness of public healthcare services. Many reasons are told by the respondents for not using government hospitals. Procedural complications is one of the most important reasons. There is a lengthy and complicated procedure in government hospitals which takes a lot of time and energy, so people avoid to avail healthcare. About 18 percent households state that long waiting time and 8 percent households state that distance as a reason while 38 percent households give more than one

reason for not using public healthcare system (Table 6.5). Poor quality of care is also a strong reason for it. A study finds that poor quality of public services is due to lack of adequate infrastructure, human resources and indifferent behaviour of public employees (Rao et al., 2005).

Table 6.5: Various reasons for not using Public Healthcare Services in Lucknow (in percent)

Type of Households	No Nearby Facility	Health Personnel often Absent	Long Waiting Time	Procedural Complications	Poor Quality of Care	More than one Reason	Other Reason
Non-slum	6.85	6.85	21.92	13.7	13.7	36.99	00
	38.46	55.56	51.61	25.0	90.91	41.54	00
Notified Slum	4.17	8.33	10.42	33.33	00	41.67	2.08
	15.38	44.44	16.13	40.0	00	30.77	100
Non-notified Slum	12.24	00	20.41	28.57	2.04	36.73	00
	46.15	00	32.26	35.0	9.09	27.69	00
Total	7.65	5.29	18.24	23.53	6.47	38.24	0.59
	100	100	100	100	100	100	100

Source: Primary Data

Note: Values in the first row reflects row wise percent and values in the second row reflect the column wise percent.

Households use a range of strategies to cope with the financial costs of illness and use of health services. It also depends on type of disease. An acute illness may impose sudden costs on the household which require sudden resource mobilization, while a chronic disease such as tuberculosis will emerge as a 'long-wave disaster', with long-term cost, response and resource implications (Russell, 1996). About 55 percent non-slum households, 26 percent notified slum dwellers and 19 percent non-notified slum dwellers use cash and savings (Table 6.6). The most common strategy is to use cash and savings for (among) non-slum households while barrowing from friends and relatives is the most prevalent method among slum dwellers. The reason is that slum dwellers do not have sufficient funds due to poverty. There are some other strategies which are less used for coping financial costs of illness such as income diversification, loan, reducing expenses and sale of assets.

Table 6.6: Various types of Coping Cost Strategies adopted by Households (in percent)

Type of Households	Borrowing	Cash & Saving	Income Diversification	Loans	Reducing Expenses	Sale of Assets
Non-slum	1.25	95.0	1.25	1.25	00	1.25
	1.28	55.47	20.0	33.33	00	25.0
Notified Slum	45.0	43.75	1.25	1.25	7.5	1.25
	46.15	25.55	20.0	33.33	46.15	25.0
Non-notified	51.25	32.5	3.75	1.25	8.75	2.5
Slum	52.56	18.98	60.0	33.33	53.85	50.0
Total	32.5	57.08	2.08	1.25	5.42	1.67
	100	100	100	100	100	100

Source: Primary Data

Note: Values in the first row reflects row wise percent and values in the second row reflect the column wise percent.

6.4 Health Cost Measurement

6.4.1 Valuation of Health Cost

Valuation is the technique for estimating the changes in human well-being attributed to the alternative action that result for a different level of environmental quality. In environmental valuation, we need to use acceptable monetary measures of welfare. If human welfare changes are expressed through ordinal utility, such measurement will have limited or no values to policy makers. Money-metric human welfare measures serve as a bridge between economic theory and practical policy making. Challenge is to estimate the value of environmental quality changes in the absence of markets.

There are two major health effects, i.e., mortality and morbidity. Mortality refers to a well-defined event-death which for ceremonial and legal reasons almost always is noted and made part of an official record. The most basic measure of mortality is the crude mortality rate of the population. This is defined as the ratio of the total number of deaths from all causes during a period of time to the average number of persons in that population. The crude mortality rate can also be interpreted as the probability that an individual member of the population will die during a given period (Freeman III, 1993). Mortality costs measure production lost because of premature death. Calculation of mortality costs considers earnings over a lifetime rather than a single year. Whereas, morbidity is defined as a departure from a state of physical or mental well-being, resulting from disease or injury, of which the affected individual is aware (Freeman

III, 1993). It can be classified in a variety of ways, among them duration of the condition (chronic or acute), degree of impairment of activity, or type of symptom.

Health costs of sampled households for morbidity are measured by using the Cost of Illness Method. We have measured health costs at household level instead of individual level. The household is an appropriate unit of analysis rather than the individual ill person as it is revealed that the large majority of time and financial costs of illness were borne by healthy household members (Sauerborn et al, 1996). As per Cost of Illness method, total cost of illness is the summation of direct and indirect costs. Direct costs include the consumption of in-patient and out-patient costs associated with medical resource utilization and pharmaceutical services within the health-care delivery system. So, the direct costs are estimated by taking consultation fee, cost of medicines, diagnostic cost and transport expenditure for acute diseases, while for semi-chronic and chronic diseases consultation fee, cost of medicines, expenditure on hospitalisation, diagnostic expenditure and transport expenditure are taken.

Indirect costs consist of work loss, worker replacement and reduced productivity from illness and decease. There are three major methods for measuring indirect costs; Human Capital Method (HCM), Friction Cost Method (FCM) and Willingness to Pay Method (WTP) (Jo, 2014). In HCM, indirect cost is measured by the market value of the productivity losses associated with morbidity and mortality. It is measured by individual's future contribution to production in a society if he had continued to work in full health. The FCM estimates indirect cost by another person's earnings who replaces the worker from the unemployment pool until the sick worker returns on work while WTP measures the indirect cost as an amount that an individual is eager to pay in order to reduce the probability of illness or mortality. The WTP approach estimates higher value of life than the HCM approach while the FCM estimates a lower cost than the human capital method in the long run (Jo, 2014).

Although, indirect costs is difficult to quantify because of a lack of quality data, but these are very important and often represent a significant percentage of the total cost associated with many diseases. Indirect costs can be measured by amount of time a person misses work as a result of a medical condition. The amount of time lost from illness vary due to differences in the condition, such as acute vrs chronic illness. These costs include the costs generated from three potential sources, including mortality, absenteeism and the reduced productivity of employees. We have estimated indirect costs generated from absenteeism of employees. Indirect cost is calculated by converting days off work due to illness into monetary terms using

the per day income of the patient to provide a proxy for the opportunity cost of time. In this way, we have measured actual income loss of employed patients due to illness.

Only employed patients do not have indirect health cost, but housewives also have it. They have to do a lot of unpaid work. Unpaid work is the production of goods and services by household members that are not sold on the market. The main component of unpaid work is routine housework (Miranda, 2011). Routine housework includes tasks as cooking, cleaning, gardening, pet care and home maintenance which are mainly done by housewives. So, we have also calculated indirect health cost of housewives whose age are between 20 years to 60 years. For this, cost is calculated using number of days of illness multiplied by the per day income of per household member. To calculate per day income of per household member, the total income of household is divided by the number of persons in that household and 30 (number of days in a month). But, no attempt was made to value indirect cost of kids, students and unemployed persons.

6.4.2 Health Expenditure of Sampled Households

The direct and indirect costs are calculated for both acute and chronic diseases. The cost of illness for acute diseases is the calculated up to fifteen days, whereas the cost of illness for chronic disease is estimated up to one year respectively. The household spends Rs. 1602 in a month to cure acute illness (Table 6.7). Both direct and indirect costs vary considerably according to the type of illness such as acute and chronic illness. The direct cost shares $3/4^{th}$ of the total cost of illness. The mean expenditure of sampled households is higher on other diseases as compared to water borne diseases for both direct and indirect costs. However, as a percentage of total cost, direct cost of water borne diseases is higher and indirect cost of other diseases is higher. But, there is no significant differences for acute illness.

The average expenditure of sampled households for semi-chronic and chronic diseases is Rs. 18,460 in a year. The expenses on other diseases are higher than waterborne diseases as these diseases include some chronic diseases such as diabetes, paralysis, liver and kidney problem and accident which are very expensive for medical treatment. Household spends Rs. 12,936 on waterborne diseases and Rs. 31,727 on other diseases. However, the share of indirect cost is significantly high for waterborne diseases as compared to other diseases. Therefore, it is found that other diseases are more expensive than water borne diseases for both acute and chronic illness in the study area.

Table 6.7: Average Costs of Diseases on Acute Illness and Chronic Illness (in Rs.)

Disease	Direct Cost	Indirect Cost	Total
Acute Illness			
Water-borne Disease	1187.27 (75.11)	393.46 (24.89)	1580.73 (100)
Other Disease	1217.25 (74.26)	421.85 (25.74)	1639.10 (100)
Total	1197.48 (74.72)	405.11 (25.28)	1602.59 (100)
Semi-chronic/ Chronic			
Water-borne Disease	9214.48 (71.23)	3722.34 (28.77)	12936.82 (100)
Other Disease	24785.80 (78.12)	6942.09 (21.88)	31727.89 (100)
Total	13772 (74.60)	4688.26 (25.40)	18460.26 (100)

Source: Primary Data.

Note: Costs of acute illness are estimated on monthly basis, whereas, costs of semi- chronic and chronic illness are estimated on annual basis.

A considerable variation can be seen in health costs across different types of households and diseases in Lucknow (Table 6.8). The cost of chronic illnesses is higher than the cost of acute illnesses in direct, indirect and total cost categories for all types of households. The mean health expenditure of the non-slum households is the highest in case of among all types of households and various types of diseases. A study also found that the cost associated with an illness episode increased as income increased (Dror et al., 2008). The average health expenditure of notified slums is much higher than that of non-notified slums in case of acute and chronic illness. The similar patterns are found in case of direct and indirect cost. The highest direct and indirect costs are paid by non-slum households followed by notified slums and non-notified slums. This shows that non-slum households have higher ability to spend than that of their counterparts. The share of direct and indirect cost to the total cost is almost similar for non-slum and notified slum households while non-notified slum dwellers spend much larger share on direct cost than that of indirect cost which is 77 percent for acute illness and 85 percent for chronic illness.

Table 6.8: Household-wise Average Costs of Diseases on Acute Illness and Chronic Illness (in Rs.)

Type of Households	Direct Cost	Indirect Cost	Total
Acute Illness			
Non-slum	1385.25 (72.13)	535.28 (27.87)	1920.53 (100)
Notified Slum	1270.62 (74.20)	441.70 (25.80)	1712.32 (100)
Non-notified Slum	1041.43 (77.56)	301.33 (22.44)	1342.76 (100)
Total	1197.48 (74.72)	405.11 (25.28)	1602.59 (100)
Semi-chronic/ Chronic			
Non-slum	19364.50 (72.68)	7279.77 (27.32)	26644.27 (100)
Notified Slum	12886 (72.90)	4790.77 (27.10)	17676.77 (100)
Non-notified Slum	9392 (85.11)	1642.83 (14.89)	11034.83 (100)
Total	13772 (74.60)	4688.26 (25.40)	18460.26 (100)

Source: Primary Data.

Note: Costs of acute illness are estimated on monthly basis, whereas, costs of semi- chronic and chronic illness are estimated on annual basis.

A disease-specific summary of treatment cost shows that in case of acute illness, persons with throat infection incur the highest average expenditure followed by typhoid and respiratory & lungs infection (Table 6.9). The most common ailments, i e, diarrhoea and fever accounts for an average cost of Rs 844 and 1184 respectively. So, the mean cost of one acute illness episode, including direct and indirect cost, is Rs. 1602. Direct costs represent about three-fourth while indirect costs represent only one-fourth. Furthermore, health costs of chronic diseases are many times to that of acute diseases as these diseases prolong for a longer period. In chronic diseases, 'Other' diseases account for an average cost of Rs. 51,533 as it include some chronic diseases which are very expensive for medical treatment such as diabetes, cardiovascular disease, paralysis, accident etc. Afterwards other diseases, Pneumonia followed by tuberculosis has the largest mean annual total spending for illness (Table 6.8). Among water

borne diseases, Jaundice followed by Dengue and Typhoid are more expensive under acute category, whereas tuberculosis is the single most expensive disease under chronic category.

Table 6.9: Disease wise Costs on Acute, Semi-Chronic and Chronic Illness (in Rs.)

Diseases	Acute			Semi-chronic/ Chronic		
	Direct Cost	Indirect Cost	Total	Direct Cost	Indirect Cost	Total
Diarrhoea	527	316.92	843.92	00	00	00
Dysentery	780.30	132.50	912.80	00	00	00
Typhoid	3036.67	893.33	3930	7150	2917.80	10067.80
Cholera	1571.50	684	2255.50	00	00	00
Jaundice	5280	400	5680	8100	1821.25	9921.25
Dengue	4880	500	5380	11788.60	4037.30	15825.90
Pneumonia	00	00	00	19950	900	20850
Eye & Skin infection	1269.83	1003.83	2273.66	00	00	00
Throat infection	1800	2915.50	4715.50	00	00	00
Malaria	3000	50	3050	4900	4000	8900
Tuberculosis	00	00	00	11458.30	6516.69	17974.99
Fever	887.81	296.10	1183.91	3315	1550.03	4865.03
Respiratory & lungs infection	1280	1970	3250	12316.70	1335	13651.70
Other	3746.67	83.33	3830	38983.30	12550	51533.30
Total	1197.48	405.11	1602.59	13772	4688.26	18460.26

Source: Primary Data.

A considerable variation can be seen among different components of direct cost for acute and chronic illness. The consultation fee, expenditure on medicine, diagnostic cost, transportation cost and hospitalisation cost are included in the direct expenditure for semi-chronic and chronic diseases while there is no hospitalization cost for acute illness. The mean costs are higher for all components of direct cost in chronic illness episodes compared to acute illness episodes (Table 6.10). In acute illness, the highest mean costs are due to medicines while mean costs of consultation and tests are almost similar. Hospitalization takes a largest share of direct cost in semi- chronic and chronic illnesses. After cost on hospitalization, medicine cost has larger share under chronic illness. After cost on hospitalization, medicine cost has larger

share under chronic illness. It is therefore observed that medicine cost takes a largest share of direct cost in both cases.

Table 6.10: Various Components of Direct Costs (in Rs.)

Type of Illness	Consultat-ion Fee	Medicine Cost	Diagnostic Cost	Hospitalization Cost	Transportation Cost	Average Direct Cost
Acute Illness						
Water borne	523.19	782.97	350.91	0	169.92	1187.27
Other Disease	445.77	922.78	668	0	185.46	1217.25
Total	495.62	811.80	487.50	0	175.43	1197.48
Semi-chronic/ Chronic						
Water borne	1751.72	5091.38	1312.50	1766.67	990	9214.48
Other Disease	2066.67	13220.80	1680	15166.70	1015	24785.80
Total	1843.90	7470.73	1409.21	10700	997.50	13772

Source: Primary Data.

6.4.3 Affordability of Healthcare Services

Affordability of healthcare services is determined by the cost of treatment, households' ability to manage these costs and its impact on the livelihood of households (Baru et al., 2010). In India, households account for about 70 percent of total health spending which is almost in the form of out of pocket expenditure (Chowdhary, 2011). An OOP expense is a non-reimbursable expense paid by the patient. As reimbursement in any form is generally availed of by those employed in the formal sector and the share of formal sector employees is very few. Healthcare is financed substantially through out-of-pocket (OOP) payments by individuals and households in Lucknow.

Out of Pocket Expenditure (OOPE)

Out of pocket expenditures are expenditures incurred by the individual / family during the illness episode. OOPE is calculated as the sum of direct medical costs and non-medical costs. It include direct payments for consultation, diagnostic test, medicines, transportation and hospitalization. It is non-reimbursable expense and if any reimbursement received by the

patient, then that amount is subtracted to calculate OOPE. Health insurance in India is not popular as less than 20 percent of Indian population is covered by insurance plans (Jain, 2020). The reason is that private insurance is only affordable to richer households (Ecks, 2021). So, health care finance in India is mainly characterized by OOP payments for health. In this study, the total medical expenditure is met entirely through OOP payments as none of the sampled households who suffer with chronic diseases has any medical insurance cover.

OOP health expenditure is also called catastrophic expenditure when it exceeds some fixed proportion of household income or household's capacity to pay in a given period. The term catastrophic implies that such expenditure levels are likely to force households to cut their consumption of other minimum needs, asset sales or high levels of debt and lead to impoverishment (Mcintyre et al., 2006). Different studies adopt different approaches to measure catastrophic health expenditure. In budget share approach, catastrophic health expenditure is measured as a share of income or consumption expenditure. In this study, catastrophic health expenditure of sampled households has been measured based on budget share approach using WHO benchmark.[17] There are various types of households are in this study such as non-slum households, notified and non-notified slum households. So, different types of household's quintiles are estimated. Further, quintile wise 'out of pocket expenditure' of income is estimated to look into the existence of intensity of inequality. The proportion of health costs to income for acute illness is estimated to the monthly income while in case of chronic illness, the share of health cost is estimated to the annual income.

The total health costs for all forms of illness for households is above 6 percent of household income; 6.83 percent of average monthly household income in case of acute illness and 6.31 percent of annual household income for chronic illness. Table 6.11 presents the distribution of the burden of illness across different types of households and reveals that the economic consequences of illness impose more burden on slum dwellers than on non-slum households. Total health cost for acute illness is found 2.7 percent of monthly income for non-slum households to 13.5 percent for notified slums and 14.9 percent for non-notified slums in Lucknow. The similar pattern is found in terms of semi-chronic and chronic diseases. Although the slum dwellers spend less on treatment than non-slum households, the spending is a higher

[17] Health expenditure is called catastrophic if it becomes more than 10 percent up to 25 percent of income or consumption expenditure (WHO & World Bank, 2017).

proportion of income. Therefore, it can be said that the out of pocket expenditure of the slum dwellers of Lucknow for curing acute, semi-chronic and chronic diseases is catastrophic in nature as per the criteria of WHO.

Table 6.11: Household-wise Mean Costs of Acute and Chronic Illness and their Share to Income

Type of Households	Direct Cost	Indirect Cost	Total Cost	Income
Acute Illness				
Non-slum	1385.25 (1.96)	535.28 (0.76)	1920.53 (2.72)	70675
Notified Slum	1270.62 (10.03)	441.70 (3.49)	1712.32 (13.52)	12664.40
Non-notified Slum	1041.43 (11.53)	301.33 (3.34)	1342.76 (14.86)	9035
Total	1197.48 (5.10)	405.11 (1.73)	1602.59 (6.83)	23462.70
Semi-chronic/ Chronic				
Non-slum	19364.50 (2.58)	7279.77 (0.97)	26644.27 (3.56)	749273
Notified Slum	12886 (10.19)	4790.77 (3.79)	17676.77 (13.98)	126420
Non-notified Slum	9392 (10.19)	1642.83 (1.78)	11034.83 (11.97)	92200
Total	13772 (4.71)	4688.26 (1.60)	18460.26 (6.31)	292644

Source: Primary Data.

Note: The values in the parenthesis are the percent of the total income.

The distribution of direct health cost among the different quantiles provides a context for examining inequality among the income quantiles of the population. It is observed that OOP direct health cost is regressive, imposing a greater burden on poor families than better-off families. The spending burden ratio is reducing as we move up the income quintiles for acute illness, the maximum being 17 percent for the 1st quintile of non-notified slum households and the minimum being 1.2 percent for the 5th quintile of non-slum households (Table 6.12). In case of chronic illness, the mean values of this ratio ranged from 33.7 percent in the 2nd quintile to 9.4 percent in the 5th quintile for non-notified slum dwellers while the mean value of this ratio range from 12.4 percent in the 1st quintile to 6.1 percent in the 5th quintile for notified

slum dwellers. Therefore, the vulnerability in terms of share of health costs to income is much higher for bottom quintile households compared to top quintile of the households.

Table 6.12: Quintile wise Direct Health Cost to the percentage of Income in the slums of Lucknow (in percent)

Type of Households	Type of Illness	First	Second	Third	Fourth	Fifth	Average
Non-slum	Acute	5.03	4.14	2.15	1.88	1.22	2.72
	Chronic	12.33	5.6	0.44	1.13	1.2	3.56
Notified Slum	Acute	8.56	17.01	9.85	9.0	6.91	13.52
	Chronic	12.38	10.12	13.56	7.35	6.11	13.98
Non-notified Slum	Acute	17.06	12.23	10.08	9.19	7.82	14.86
	Chronic	--	33.72	27.39	12.68	9.41	11.97
Total	Acute	11.21	14.08	9.76	6.58	3.06	6.83
	Chronic	12.86	15.38	10.83	8.29	5.04	6.31

Source: Estimated from Primary Data.

6.5 Determinants of Illness

Various economic, demographic and environmental factors are responsible for illness, such as age, education, income, family size, type of drinking water and sanitation facility, etc. To find out the probability of any member in the household for suffering from any type of diseases during last one year, an empirical model has been developed. Besides drinking water and hygiene facility, some other variables such as age, family size and education are also considered as independent variables in the model.

All the independent variables are converted into binary forms for binary logistic regression analysis. Age of the household members is classified into two categories, members up to 15 years as children and above 15 years as other category. The family size having up to five members is considered as small and more than five members as large family. Education of the household member is categorised into two groups such as having education up to primary in one group and above primary in other group. Under drinking water facility, drinking water is categorised as whether the household has access to safe drinking water within premises into one category and not into another category. Hygiene facility is categorized as whether the handwashing facility is available into one category and others are another group.

The dependent variable is a binary variable and it takes a value 1 for the households whose member is suffered from any type of illness acute or chronic during the last one year and 0 otherwise.

$$\text{Log } \lambda_i = \alpha + \beta_1 \text{ AGE} + \beta_2 \text{ SIZE} + \beta_3 \text{ EDU} + \beta_4 \text{ DWP} + \beta_5 \text{ HF} + \varepsilon_i$$

Where AGE means age, SIZE means family size, EDU means education, DWP drinking water in premises, HF means hygiene facility and ε_i is error term.

The regression coefficients confirm that age, size, education and access to safe drinking water have significant impact on illness (Table 14). Age has positive relationship with illness. It implies that the children up to 15 years have higher chance to be ill than an elder person. The odd ratio confirms that the probability of suffering from any type of illness in the age group of children up to 15 years of age is 1.96 times higher than those of more than 15 years of age. The reason is water borne diseases are prevalent in study area and children up to 15 years of age suffer more from water borne diseases. Household size is also an important factor. The positive coefficient of household size implies that large families are less likely suffered from any illness than from small families. The odd ratios reveal that members of small family suffer at a higher extent from various types of diseases than that of members belonging to large families.

The educational experience of the person plays a strong and significant role for health impacts. The positive coefficient indicates that a literate person has comparatively less chance to be ill. The predicted estimates indicate that the likelihoodness of being ill is 1.68 times higher for those household members that are educated up to primary or illiterate as compared to more educated persons. Drinking water plays a crucial role in our lives. As predicted access to safe drinking water within premises has negative relationship with various types of diseases. Households having drinking water source within premises, the probability of suffering from water borne and other types of diseases is less than those of houses having no drinking water source within premises. Thus, water source within premises is not only necessary for health risk, but also for the opportunity cost of time lost in collecting water (Rao, 2009).

However, hygiene is not significantly related to illness but positive coefficient of hygiene variable implies that households having no handwashing facility have higher probability to be ill. However, together all the regressors have a significant impact on the drinking water facility in premises, as the LR statistics is 39.69, whose p value is about 0.0000, which is very small. The likelihood ratio test statistics indicate that the explanatory variables

used for predicting the probability of being ill explain a fairly good-fit in the model. Therefore, the above regression analysis suggests that improvement in drinking water facility and education system can reduce the probability of suffering from various types of diseases.

Table 6.13: Result of Logistic Regression (Determinants of Illness)

Variables	Description of Variables	Coefficient	Z	P value	Odd Ratio
Age	Age group up to 15 years =1, others =0	0.6711	3.40	0.001	1.96
Family size	Family size up to 5 = 1, others =0	0.4545	2.29	0.022	1.58
Education	Education up to primary =1, others =0	0.5184	2.26	0.024	1.68
DWP	Drinking Water in Premises =1, others =0	-0.3548	-1.72	0.086	0.70
Hygiene	No handwashing facility =1, others =0	0.2477	0.73	0.463	1.28
Constant		-2.6854	-9.90	0.000	0.07
	Log Likelihood	-399.43655			
	No. of Observations	1178			
		39.69			
	LR Chi^2 (5)	(0.0000)			
	Pseduo R^2	0.0473			

1.6 Summary & Conclusions

The chapter has made an attempt to present health status and to measure health cost of sampled households. About 11 percent people are suffered from any kind of illness; acute or chronic in the study area. The number of cases is higher for acute illness as compared to semi-chronic and chronic illness for all types of households It is observed that non-slum households report lowest for all types of illness, however, scenario in notified and non-notified slums is more or less same. Water borne diseases are more prevalent in the study area and slum dwellers are more suffered with water-borne diseases such as diarrhoea, cholera, typhoid etc. due to inadequacy of safe drinking water and sanitation facilities.

Most of the households mainly depend on private healthcare services. About 70 percent sampled households do not go to the government hospitals due to procedural complications, long waiting time, poor health services. It is found that other diseases are more expensive than water borne diseases for both acute and chronic illness in the study area as these diseases include some chronic diseases such as diabetes, paralysis, liver and kidney problem

and accident which are very expensive for medical treatment. The out of pocket expenditure of the slum dwellers of Lucknow for curing acute, semi-chronic and chronic diseases is catastrophic in nature as per the criteria of WHO. It is observed that OOP direct health cost is regressive, imposing a greater burden on poor families than better-off families. Therefore, the vulnerability in terms of share of health costs to income is much higher for bottom quintile households as compared to top quintile of the households.

The results of binary logistic regression reveal that the variables such as age, family size, education and drinking water within premises have significant impact on health. It can be said that households having safe drinking water source, have less probability of suffering any type of illness. A report also finds that unsafe water and sanitation is the fourth leading risk responsible for disease burden in Uttar Pradesh, contributing 6 percent of the total disease burden, mainly through diarrhoeal diseases in 2016 (ICMR, PHFI & IHME, 2017). So, improvement in water supply and its infrastructure especially in slum areas is essentially needed to decrease the disease burden of slum dwellers.

CHAPTER - 7

Major Findings & Conclusions

7.0 Introduction

Drinking water and sanitation are important basic needs of every human. Human health depends on safe and sufficient amount of water, adequate sanitation and hygienic conditions. Unfortunately, on account of rapid increase in urban population, provision of adequate water supply and sanitation is a daunting task for developing countries like India. It is estimated that the demand for water is growing three times faster than the population and that by the year 2025, the population deficient in water would increase from 450 million to about 3000 million, based on business-as-usual projections (Kundu & Thakur, 2006). Urban expansion has placed cities of India in a challenging situation with limited infrastructure facilities which adversely affect the quality of life of people especially slum dwellers.

The study has made an attempt to identify and evaluate inequities in access to drinking water and sanitation facility between slum and non-slum areas in Lucknow city, Uttar Pradesh. It has also made an attempt to present health status and to measure health cost of slum and non-slum households. The study has used primary data and secondary data to analyse various objectives of study. Secondary data are used to analyse the macro level condition of drinking water and sanitation facility of slum and non-slum households at national and state level. Primary data are used to show the actual status at micro level. The study also focuses on measuring the factors affecting drinking water in premises, improved sanitation facility and basic hygiene sanitation facility. The study also measures multidimensional poverty of slum dwellers.

7.1 Major Findings and Conclusions

The chapter entitled **"Introduction"** provides conceptual framework of drinking water and sanitation.

First, there are four types of goods on the basis of exclusion and rivalry, viz., private goods, public goods, club goods and common-pool resources. Drinking water and sanitation is neither pure private goods nor pure public goods. Water has the characteristics of impure public good, or a common pool resource that is non-excludable yet rival in consumption.

Second, drinking water and sanitation are merit goods. For instance, a household with access to clean drinking water and sanitary facilities is less likely to contact and spread water-borne diseases. The greater the spread of water and sanitation, the greater are its benefits.

Third, water and sanitation are not just basic needs but fundamental human rights based on the criteria established in international declarations that protect the right to livelihood and well-being.

Therefore, water and sanitation are best seen as impure public goods with local, national, or regional benefits and costs. Access to safe drinking water and adequate sanitation facility is not just a fundamental human right and an intrinsically important indicator for human progress.

The second chapter entitled **"Socio-Economic Aspects of Study Area"** deals with socio-economic status of sampled households. It deals with demographic profile, housing characteristics, educational status, occupation and income of study area.

household possessions

First, the demographic structure of Lucknow city is different from the district and state level. Sex ratio, density and decennial growth are much higher in Lucknow city as compared to the district and state average mainly due to the extension of the jurisdiction of the Lucknow Municipal Corporation.

Second, Lucknow is one of the most populous cities of Uttar Pradesh. The average household size in the study area is 4.92 with a range of 2 to 13 persons per family. The sampled population consists of various types of households, i.e., non-slum, notified and non-notified. Most of the slum households whether they live in notified slums or in non-notified slums, belongs to the OBC and SC while general category is the dominant group in non-slum households.

Third, housing is one of the prime indicators to assess the existing condition of a slum. Housing status by type of households reveals that majority of non-slum households live in pucca house while slum dwellers live in semi-pucca and kutcha houses. There are few non-notified slums, i.e., Jawahar Nagar of Daliganj ward and Luvkush Nagar of Lal Bahadur Shastri ward, where all households live in kutcha houses.

Fourth, education is one of the most important socio-economic factors. In this survey, the literacy measure was based on self-reported literacy. As per Census definition, 68 percent population out of 1064 persons is literate in the study area and 32 percent of the sampled population continues to have no education. Literacy is least among men and women who live in non-notified slums.

Fifth, it is observed that about 41 percent of the population are economically active. Majority of slum dwellers work in unproductive and lower wage jobs. The share of casual labour is the highest in non-notified slum households. Non-slum households are comparatively at a higher level of occupation as compared to slum households because of higher educational attainment.

Socio-economic profile of study area shows that every slum is different in its origin, location, size and demographic characteristics. The large scale inter and intra disparities across slum households and non-slum households are found in terms of housing status, education, occupation and income in the field survey. It may be concluded that the study area is marked by sharp economic and social inequalities among different types of households.

The third chapter entitled **"Multidimensional Poverty of Slums in Lucknow"** estimates Multidimensional Poverty Index by using the dual cut-off method based on counting approach developed by Alkire and Foster (2018) for slum and non-slum households in Lucknow district. The objective of this chapter is to measure multidimensional poverty especially in slum areas.

First, a considerable variation can be seen in MPI values across Indian states from a low of 0.004 in Kerala to a high of 0.248 in Bihar as per the data provided by Global Multidimensional Poverty Index, 2019. However, MPI values of states are reduced during the period between 2005-06 and 2015-16, but the rankings of Bihar, Jharkhand and Uttar Pradesh have not improved during the period.

Second, it is observed that there is no MPI poor in the non-slum areas. However, it is found some deprivation in non-slum households on health dimension, such as in nutrition indicator.

Third, the MPI index is 0.278 with nearly 49.8 percent population are multidimensionally poor in the study area. The MPI value of non-notified slums is about 2 times higher than the MPI value of notified slums. The comparative analysis between notified and non-notified slums shows that the condition of non-notified slum households are miserable as 72 percent of populations of non-notified slums are suffering from severe poverty as compared to 17 percent populations of notified slums.

Fourth, the MPI index is based on the three dimensions, viz., education, health and living standard. Living standard contributes the most in MPI index among three dimensions for both notified and non-notified slums. It is also proved by a study of Dotter & Klasen (2014). High

incidence of the standard of living poverty is also a reflection of poor provision of basic needs of life.

Fifth, the study finds extensive disparities in Multidimensional Poverty Index across slums in Lucknow. The range of MPI value is 0.083 in Chota Burha slum to 0.464 in Behasa slum among all sampled notified slums. There are five non-notified slums, i.e., Baluadda, Jawahar Nagar, Amausi, Cheeken wali Guli and Luvkush Nagar where all sampled population is MPI based poor.

Sixth, the regression analysis has been used to find out the determinants of multidimensional poverty. The estimated coefficients confirm that income plays a strong, significant and negative association with multidimensional poverty. This implies that the probability of being MPI poor decreases when income of the household increases. With respect to social group, the positive coefficient implies that the probability of being MPI poor for OBC and SC groups is higher than Other category. This is consistent with the result of other studies (Deshpande 2003; Gang et al., 2011).

The chapter highlights the existing disparities in multidimensional poverty at state level in India and at district level in Uttar Pradesh. Wide disparity can be seen in terms of headcount ratio, intensity of poverty and MPI values among different types of households. The analysis also finds unevenly distributed multidimensional poverty across slums in Lucknow, where Chota Burha slum, a notified slum of zone 5 is least deprived while Jawahar Nagar slum, a non-notified slum of Zone 3 is most deprived among all slums. The condition is very pathetic in non-notified slums.

The results of multivariate logistic regression clearly confirm that the variables such as family size, income and caste have significant impact on multidimensional poverty. It can be said that the probability of being MPI poor is significantly very high if the household belongs to lower income group in lower caste such as SC and OBC community.

The fourth chapter entitled **"Status of WASH Conditions in Lucknow**" makes an attempt to present the current status of WASH conditions at national, state and district level and to evaluate inequities in access to drinking water and sanitation facility between slum and non-slum areas in Lucknow. It also deals with analysing the factors affecting the drinking water facilities within premises, improved sanitation facility and basic hygiene facility.

First, a significant difference can be seen in access to drinking water sources and sanitation facility between slum and urban households in Uttar Pradesh and India. However, a greater percentage of urban and slum households in Uttar Pradesh have access to water within the premises than these types of households in India.

Second, there are five principal sources of drinking water; viz., piped water, public tap, bore-well, community owned bore-well and hand-pump in the study area. The majority of the sampled households depend on municipal water supply, i.e. 39 percent. Access to underground water is the next most important source account for 24 percent households depend on community owned bore-well and 13 percent households depend on bore-well, while 22 percent households obtain their drinking water from public tap.

Third, there are significant disparities among non-slum areas, notified slums and non-notified slums with regard to distance to drinking water source. About 98 percent households of non-slum area obtain their drinking water within dwelling while the notified slum dwellers share the highest proportion of drinking water source outside dwelling within premises and non-notified slum dwellers have to go far for obtain water.

Fourth, it is observed that non-slum households have higher access to attached bathroom while notified slum dwellers have higher access to detached bathroom as compared to all sampled households. About 94 percent households of non-slum area use toilets with 'flush/pour flush connected to the sewer system', while 81 percent households of notified slums use septic tank. On the other hand, 65 percent households of non-notified slums practiced open defecation.

Fifth, the inequality in access to drinking water and sanitation facility has been measured by diversification index.

(a) Household-wise analysis shows that the households of non-slum areas are least diversified while households of notified slums are most diversified. In other words, slum dwellers have diversified sources of drinking water as they do not avail of bore-wells and they have few piped water connections. They have to fetch their water from public tap, community owned bore-well or hand-pumps.

(b) The index also provides evidence that accessibility to toilet facility for households of non-notified slums is the most diversified compared to other households.

Sixth, the Joint Monitor Programme (JMP) has classified hygiene facility into three categories, viz, basic facility, limited facility and no facility. According to JMP classification, about 53

percent households of study area have basic hygiene facility while 40 percent households have limited hygiene facility.

Seventh, micro environmental facilities such as, availability of sewer lines and drainage system, facility of garbage disposal system also play an important role to keep the residents healthy. About 46 percent households report that sanitation system of their respective houses is connected with the underground sewer system. The condition of the non-notified slum dwellers is more vulnerable as none of the non-notified slum house is connected with underground sewer system while all non-slum houses are connected with underground system. 'Underground drainage' is the most common type of drainage system in non-slum areas while 'open pucca' and 'open kachcha' are the most prevalent drainage system in notified slums and non-notified slums respectively.

Eighth, the chapter empirically analyses the factors affecting drinking water in premises, improved sanitation facility and basic hygiene facility using the bivariate Logistics Regression Analysis. The estimation is carried out in **two models.** In the first model, all sampled households are included while in second model, only slum dwellers are included.

(a) Among the factors on socio-economic profiles of the households, religion, caste, income and housing conditions have significant impact on drinking water in premises in both types of models while age and education of household head make no difference as the variables are statistically insignificant.

(b) It is found that religion and type of house play strong, positive and significant association with access to improved sanitation facility. Various types of poverty is negatively related to the dependent variable that means probability of having improved sanitation facility is lower for poor households than non-poor. However, these coefficients are significant only for pooled sample.

(c) it is clearly revealed that basic hygiene facility is affected by age, caste and housing conditions. The negative coefficients reveal that OBC and SC households are less likely to have basic hygiene facility as compared to general category households in both models. The probability of having basic hygiene facility is 4 times higher in model 1 and about 3 times higher in model 2 for the households living in pucca house more than those households who live in semi-pucca and kuchcha house.

Therefore, there is considerable variation in access to WASH facilities among non-slum areas, notified slums and non-notified slums. The main source of drinking water is piped water and bore-well for non-slum households while community tank and public tap for slum households. It is clearly proved by diversification index that the households of non-notified slums have to face great hardship in accessing drinking water and sanitation facility as compared to other households. None of the non-notified slum house is connected with underground sewer system. More than half non-notified slum dwellers do defecate openly. The main reason is that they do not have latrine facility at their houses.

The results of logistic regression clearly identify that the religion, caste, income and type of house act as important socio-economic factors affecting access to drinking water in premises, improved sanitation facility and basic hygiene facility. However, age and type of family are the other important factors. The estimation is carried out for the slum households separately and also for the pooled sample of slum and non-slum households, but the results show no difference in determining factors in both models.

The fifth chapter entitled **"Coping Cost: Strategies and Management"** identifies the coping strategies and estimates associated costs for erratic, unsafe, and inadequate water supply in the city of Lucknow, Uttar Pradesh.

First, safely managed drinking water facility includes water accessibility, water quality, sufficiency and reliability as per modified JMP classification. But in Lucknow, municipal water is not available for 24 hours a day, a majority of households report that water is available twice a day for only 4 to 6 hours. Low pressure is another problem of municipal water supply. About 41 percent of the households reveal that sometimes low pressure occurs in water supply, while 9 percent households reveal that low pressure is always in water supply. Water quality is also not found up to the mark in terms of taste and smell and about 54 percent households report insufficiency of water.

Second, coping strategies refer to the specific efforts of households to unreliable water supply. Households have to face water shortage, irregular supply with low pressure and various water quality problems. To combat this situation, households adopt various coping strategies; collecting, pumping, storing, treating and purchasing. The study also finds that households often engage in multiple coping strategies.

(a) About 37 percent sampled households have to go far to collect their water. Women and girls bear the primary burden of water collection. Mean collection time of total households is 38 minutes per day and 1145 minutes per month. It is observed that there is no collection time for non-slum households while average collection time per day of notified slum dwellers is 31 minutes and it is 43 minutes for non-notified slum dwellers.

(b) One of the main coping strategy to enhance water quantity is drilling tube wells or usage of booster pumps by piped water users. Average pumping time is 42 minutes per day and it is higher for piped water users than tube well users.

(c) The households use different types of storage devices, such as bucket, ground tank and overhead tank. Overhead water tank is the main form of home storage for non-slum households. Almost non-notified slum dwellers use buckets for storing water.

(d) About one-fourth of the sampled households use water purification method. Filtration (either ceramic or electronic) is the most common method of household water treatment. The main reason for not purifying water among slum dwellers is budget constraint.

(e) Purchasing of can water is also reported in the study. Only 7 households buy can water. None of the slum dwellers purchase can water as it is very expensive.

Third, the adoption of any coping strategy carries costs. Coping cost can be classified into direct cost and indirect cost; capital cost and recurring cost. Five types of coping cost are revealed in the survey.

(a) The opportunity cost of time spent for water collection has been estimated for households that collect water from public taps, handpumps or community owned borewells, which include households mostly from non-notified slums. The average collection cost is Rs. 469.30 per month. It is the highest for community owned borewells among all sources.

(b) Households that used different types of pumps are asked about the costs of putting it. The costs differed across types of pumping and drawing equipment used. The mean pumping cost is Rs. 161 per month and it includes monthly capital cost on pumps and monthly pumping cost. The average pumping cost for the municipal water users and borewell users is Rs. 118 and Rs. 258 per month, respectively.

(c) The cost of the storage tank is amortized to monthly costs, assuming 20 years lifespan. About 88 percent non-slum households have invested in overhead tanks and about 46 percent notified slum dwellers have invested in ground tanks. The mean storage cost is Rs. 3 per month.

(d) About 18 percent sampled households have invested in electronic purifiers and about 6 percent households have invested in simple water purifiers. The average filtration cost for simple water purifier and electronic purifier is Rs. 146 and Rs. 290 per month, respectively.

(e) Only 3 percent households purchase can water. A 20 litre can of water costs approximately Rs. 70 in Lucknow. The average monthly purchase cost is Rs. 220.

Fourth, the average coping cost for sampled households is about Rs. 389 per month. There is considerable variation in various types of coping costs among all sources. For instance, collection costs are higher for community owned bore-well users and public tap users while pumping costs and treatment costs are higher for bore-well users and piped water users.

Fifth, there are significant differences in coping costs across different types of households in Lucknow. it is found that non-slum households spend more on pumping, storage and purchasing of can water while slum dwellers spend more on water collection. It is highest for non-notified slum dwellers, i.e., Rs. 528 per month.

Sixth, multiple Regression Analysis by using Ordinary Least Square method has been used to find out the determining factors of coping costs. It examined the impact of family size, education of the household head, per capita income, drinking water sources and household's perception about water quality on total coping costs. Household size and per capita income has a positive and significant impact on total coping costs. This implies that as household size goes up by one person, on average, total coping costs goes up by about Rs. 56 keeping other variables remains constant. Further, the regression result shows that households who use municipal piped water have to spend least coping cost as compared to other sources as all dummies of sources have positive and significant slope coefficients.

The study found that Lucknow Jal Nigam does not provide safely managed drinking water to its citizens as per modified JMP classification, safely managed drinking water facility includes water accessibility, water quality, sufficiency and reliability, but municipal water supply is not reliable in terms of quality as well as quantity. The majority of households reveal low pressure and shortage of regular water supply.

The average coping cost borne by sampled households is about Rs. 389 per month. The study reveals that consumers in Lucknow especially slum dwellers are bearing huge costs to cope with the inadequacies of water supply services currently being provided. Non-notified slum dwellers have to bear highest coping cost which is mainly due to collection costs (time costs in traveling and queuing for collecting water). The regression results show that drinking water source is the main determinant of coping cost and different types of water source users have to bear different types of costs. Family size and income is positively related to coping costs. These results are consistent with the results from earlier studies on coping studies like Amit & Sasidharan (2019), Cook et al. (2016) and Pattanayak et al. (2005).

The sixth chapter entitled **"Valuation of Health Cost in Lucknow"** makes an attempt to present health status and to measure health cost of sampled households by using Cost of Illness method in the study area.

First, about 11 percent people are suffered from any kind of illness; acute or chronic in the study area. The number of cases is higher for acute illness as compared to semi-chronic and chronic illness for all types of households. The study has major focus on water-borne diseases and sanitation related diseases. So, the diseases have been classified into water-borne diseases and others**.** There is found 91 cases of water-borne diseases while 44 cases of other type of diseases. The number of cases of acute water-borne diseases is almost double of other diseases in the study area. It is observed that children are more exposed to acute illness while the adults are more prone to chronic diseases.

Second, some diseases such as, diarrhoea, typhoid, dysentery, fever, skin & eye infection are more prevalent in the study area. About 21 percent from all the types of illness are reported as diarrhoea while 10 percent from all the types of illness are reported as typhoid. Further, seven percent among all the illness are reported as affected by dysentery and 80 percent among them are reported in slums. All cases are acute in nature. It can be said that water borne diseases are more prevalent in the study area and slum dwellers are more suffered with water-borne diseases.

Third, four types of healthcare sources are found in the study area, such as public, private, trust hospital, unregistered local practitioner (hakeem). About 59 percent households use private healthcare source, 8 percent households go to the trust hospital while 26 percent households use public healthcare services. Only 10 percent non-slum households use public

healthcare services, while about 34 percent slum dwellers use it. Many reasons are told by the respondents for not using government hospitals. Procedural complications is one of the most important reasons.

Fourth, households use a range of strategies to cope with the financial costs of illness and use of health services. The most common strategy is to use cash and savings for (among) non-slum households while barrowing from friends and relatives is the most prevalent method among slum dwellers. The reason is that slum dwellers do not have sufficient funds due to poverty.

Fifth, health costs of sampled households are measured by using the Cost of Illness Method. In Cost of Illness method, total cost of illness is the summation of direct and indirect costs. Direct costs include the consumption of in-patient and out-patient costs associated with medical resource utilization and pharmaceutical services within the health-care delivery system while indirect costs consist of work loss, worker replacement and reduced productivity from illness and decease.

Sixth, the direct and indirect costs are calculated for both acute and chronic diseases. The household spends Rs. 1602 in a month to cure acute illness. Both direct and indirect costs vary considerably according to the type of illness such as acute and chronic illness. The highest direct and indirect costs are paid by non-slum households followed by notified slums and non-notified slums. This shows that non-slum households have higher ability to spend than that of their counterparts.

Seventh, a considerable variation can be seen among different components of direct cost for acute and chronic illness. In acute illness, the highest mean costs are due to medicines while mean costs of consultation and tests are almost similar. Hospitalization takes a largest share of direct cost in semi- chronic and chronic illnesses.

Eighth, out of pocket expenditure (OOPE) is calculated as the sum of direct medical costs and non-medical costs. It is non-reimbursable expense and if any reimbursement received by the patient, then that amount is subtracted to calculate OOPE. In this study, the total medical expenditure is met entirely through OOP payments as none of the sampled households who suffer with chronic diseases has any medical insurance cover.

Nineth, the logistic regression results confirm that the variables such as age, family size, education and access to safe drinking have significant impact on illness. However, hygiene is

not significantly related to illness but positive coefficient of hygiene variable implies that households having no handwashing facility have higher probability to be ill.

The study found that non-slum households report lowest for all types of illness, however, scenario in notified and non-notified slums is more or less same. Water borne diseases are more prevalent in the study area and slum dwellers are more suffered with water-borne diseases such as diarrhoea, cholera, typhoid etc. due to inadequacy of safe drinking water and sanitation facilities. Most of the households mainly depend on private healthcare services. About 70 percent sampled households do not go to the government hospitals due to procedural complications, long waiting time, etc. It is found that other diseases are more expensive than water borne diseases for both acute and chronic illness in the study area as these diseases include some chronic diseases such as diabetes, paralysis, liver and kidney problem and accident which are very expensive for medical treatment.

The out of pocket expenditure of the slum dwellers of Lucknow for curing acute, semi-chronic and chronic diseases is catastrophic in nature as per the criteria of WHO. It is observed that OOP direct health cost is regressive, imposing a greater burden on poor families than better-off families. Therefore, the vulnerability in terms of share of health costs to income is much higher for bottom quintile households as compared to top quintile of the households. The results of binary logistic regression reveal that the variables such as age, family size, education and drinking water within premises have significant impact on health. It can be said that households having safe drinking water source, have less probability of suffering any type of illness.

7.2 Policy Recommendations

People need clean water and sanitation to sustain their health and maintain their dignity. Based on findings, some of the policy recommendations can be suggested.

1. Adequate water, sanitation and hygiene (WASH) services are essential for health, economic development, and environmental protection. The study found that non-notified slum dwellers have to face much hardship in access to WASH services. Due to lack of property rights, they are unable to get advantages of government schemes. Nolan et al. also found positive and significant relationship between legal status and the severity of deprivation in access to basic

services (Nolan et al., 2018). This has important policy implications because it suggests that non-notified slums should be recognized and notified by the state government so that these slums could avail the facilities provided to notified slums by the government.

2. The water supply in Lucknow is not reliable in terms of quantity as well as quality. The study found that consumers in Lucknow are bearing huge costs to cope with the inadequacies of water supply services currently being provided. Therefore, there is urgent need to take efforts by Lucknow Jal Nigam to provide good quality and reliable water supply to its citizens.

3. A good source of drinking water has significant impact on human well-being and productivity as when water comes from improved and more accessible sources, people spend less time and effort physically for collecting it, so they can be productive in other ways. The study also found that non-notified slum dwellers have to bear highest coping cost which is mainly due to collection costs (time costs in traveling and queuing for collecting water). Therefore, the government should provide piped connections to non-notified slum households so that they can spend their time on productive work and enhance their living standard.

4. Unsafe water supply is one of the important leading risk responsible for disease burden especially in slum areas. The study results confirm that households having safe drinking water source, have less probability of suffering any type of illness. Slum dwellers spend a significant amount for curing diseases which is catastrophic in nature and they are forced to sacrifice other basic needs, self-productive assets or incur debt. So, improvement in water supply and its infrastructure especially in slum areas is essentially needed to decrease the disease burden of slum dwellers.

5. Open defecation is a serious problem especially for non-notified slum dwellers as they do not have any type of latrine facility. The government should provide public latrine facility at subsidized rates or without payment in slum areas.

6. Urban population of India is increasing rapidly which creates deficiencies on the limited urban infrastructure resulting growing number of slum dwellers. Slums are often characterized as the residence of urban poor as the prevalence of poor is much higher in slums as compared to non-slums. This study has also measured multidimensional poverty of sampled population. As per the study results, living standard contributes the most in MPI index which is a reflection of poor provision of basic needs of life. So, the government should provide basic necessities of its citizens efficiently especially for slum dwellers.

7. The study found that the probability of being MPI poor is significantly very high if the household belongs to lower income group. Education is the first step to empowerment. So, significant governmental efforts for improvement of educational standards including skill development are required to directly increase income and reduce poverty in slum areas. The government should implement income generating programmes for urban poor. At least one person from each family to be employed in these programmes.

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APPENDICES

Appendix 6.1: Age-wise Diseases in Lucknow (in percent)

Age Group	Acute	Semi-chronic & Chronic	Total
0 – 5 years	16 (80) (17.02)	4 (20) (9.76)	20 (100) (14.81)
6 - 15 years	32 (84.21) (34.04)	6 (15.79) (14.63)	38 (100) (28.15)
16 – 60 years	35 (57.38) (37.23)	26 (42.62) (63.41)	61 (100) (45.19)
Above 60	11 (68.75) (11.70)	5 (31.25) (12.20)	16 (100) (11.85)
Total	94 (69.63) (100)	41 (30.37) (100)	135 (100) (100)

Source: Primary Data

Note: Values in the first row reflects row wise percent and values in the second row reflect the column wise percent.

Appendix 6.2: Age-wise of Diseases in Different Types of Households (in percent)

Age Group	Non-slum Households	Notified Slum	Non-notified Slum	Total
0 – 5 years	1 (5) (3.23)	8 (40) (14.81)	11 (55) (22)	20 (100) (14.81)
6 - 15 years	6 (15.79) (19.35)	17 (44.74) (31.48)	15 (39.47) (30)	38 (100) (28.15)
16 – 60 years	18 (29.51) (58.06)	24 (39.34) (44.44)	19 (31.15) (38)	61 (100) (45.19)
Above 60	6 (37.50) (19.35)	5 (31.25) (9.26)	5 (31.25) (10)	16 (100) (11.85)
Total	31 (22.96) (100)	54 (40) (100)	50 (37.04) (100)	135 (100) (100)

Source: Primary Data

Note: Values in the first row reflects row wise percent and values in the second row reflect the column wise percent.

HOUSEHOLD SCHEDULE

Serial Number……..

Section A. Household Profile

1. Name of the respondent (give full name)…….....

2. Ward…….....3.Zone……

4. Name / No. of the Slum.....

5. Religion: (Hindu-1, Muslim-2, Christian-3, others-4) ☐

6. Category: (General-1, OBC-2, SC-3, ST-4) ☐

7. Family Status: (Joint-1, Nuclear-2) ☐

8. Housing Characteristics: (Owned-1, Rented-2) ☐

9. Housing status: (Pucca house-1, Semi pucca house-2, Kutcha house-3) ☐

10. Identification card: (Voter Id-1, Ration card-2, Aadhar card-3) ☐

11. Ration card: (APL card-1, BPL card-2, Antyodaya card-3) ☐

12. Member's information:

SI. N0.	Name	Age*	Height	Weight	Gender #	Education **	Marital Status	Occupation
1	2	3	4	5	6	7	8	9
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								

*Age in completed years, # Male-1, Female-2, **Highest standard completed

Multidimensional Poverty

Indicator	**Yes (1) No (2)**	**Weights**	**Total Weights**
Household size -			
Education			
Everyone has completed six years of schooling		16.67%	
At least one school-age child not enrolled in school		16.67%	
Health			
At least one member is malnourished		16.67%	
One or more children have died		16.67%	
Living Conditions			
Electricity		5.56%	
Access to clean drinking water		5.56%	
Access to adequate sanitation		5.56%	
House has dirt floor (sand or dung)		5.56%	
Using dirty cooking fuel (dung/firewood/charcoal)		5.56%	
Access to information and has assets related to mobility or assets related to livelihood*		5.56%	

*Asset related to information (radio/television/telephone), mobility (bike/motor-bike/car/truck/animal cart) and livelihood (refrigerator/computer)

Livelihood pattern

Indicator		**Quantity**
Access to credit (Yes-1, no-2)		
Credit by bank-1, by local money lender-2, by neighbour-3, by relative-4, by friend-5, others-6		
Available stock- bank account-1, Liquid asset (livestock-2, jewellary-3), others-4		
No. of services (school/health centre/ road) in 10 minutes walk		
Access to public/private transport (Yes-1, no-2)		
If private transport specify		
Availability of production equipment (sewing machine etc.) (Yes-1, no-2) specify		
Membership in any organisation/group (Yes-1, no-2)		
Type of organisation		
People on whom you depend on for support (relation)		
Is it easy to access local centre and resources? (Yes-1, no-2)		
Land owned (Yes-1, no-2)		
Are you able to save (Yes-1, no-2)		
Do you get pension or other transfers from state & remittances		

Section B. Existing Drinking Water Services

1. The principle source of drinking water: (municipal piped water-1, public tap-2, bore-well/tube-well-3, hand-pump-4, community tank filled by bore-well/tube-well-5, well-6, bottled water-7, others-8)

2. Secondary source of drinking water: (municipal piped water-1, public tap-2, bore-well/tube-well-3, hand-pump-4, community tank filled by bore-well/tube-well-5, well-6, bottled water-7, others-8)

3. Distance to the principle source of drinking water: (within dwelling–1, outside dwelling but within the premises–2, outside premises at distance < 0.2 Km.-3, outside premises at distance 0.2-0.5 Km.-4, outside premises at distance 0.5-1.0 Km.-5, outside premises at distance beyond 1.0 Km.-6)

4. Is improved source of drinking water free from contamination? (yes-1, no-2)

5. Time spend for water collection (walking + waiting): (1 to 10 minutes-1, 11 to 20 minutes-2, 21 to 30 minutes-3, Above 30 minutes-4)

6. The person who fetch the water: (adult woman-1, adult man-2, female child (under age 15 years)-3, male child (under age 15 years)-4, others-5)

7. How many trips do you have to do in a day?

8. Is the quantity of water that you receive sufficient: (yes-1, no-2)

9. The frequency of water supply: (24 hour supply-1, more than once a day-2, once a day-3, once in two days-4, once in four days-5, can't say-6)

10. Is the pressure of piped water a problem? (no-1, sometimes-2, always-3)

11. How does the water smell? (no smell-1, foul smell-2)

12. Generally, what does the water look like? (clean-1, cloudy/dirty-2)

Section C. Hygiene Practices & ***Sanitation Conditions***

1. The material of main container for storage of drinking water: (stainless steel-1, brass-2, copper-3, plastic-4, other-5)

2. The mode of taking out water from container: (through tap-1, poured out-2, vessel with handle dipped in to take out water-3, vessel without handle dipped in to take out water-4)

3. How do you wash your hands? (under tap using soap-1, water from bucket with soap-2, lack of soap or water-3, no hand washing facility-4)

4a. Do you wash hands before preparing food? (yes-1, no-2)4b. Do you wash hands after critical times or visiting toilets? (yes-1, no-2)

4c. Do you wash hands before taking meals? (yes-1, no-2)

5. Type of bathing facility: (attached bathroom-1, detached bathroom-2, no bathroom-3)

6. Type of toilet facility: (flush/pour-flush to: piped sewer system-1, septic tank-2, pit latrine-3, pit latrine with slab-4, pit latrine without slab-5, open defecation-6, other-7)

7. Access to latrine: (exclusive use of household-1, common use of households in the building-2, public/community latrine without payment-3, public/community latrine with payment-4, others -5)

8. Distance of dwelling from the latrine: (within premises-1, outside premises at distance < 0.2 Km.-2, outside premises at distance 0.2-0.5 Km.-3, outside premises at distance 0.5-1.0 Km.-4, outside premises at distance beyond 1.0 Km.-5)

9a. Do you use toilet? (yes-1, no-2)

9b. Reason for not using toilet: (Inadequate water-1, Inadequate space within toilet-2, improper ventilation-3, insufficient lighting-4, poor maintenance & hygiene-5, behavioural issues-6, other-7)

10. Is excreta safely disposed of in situ or treated off side? (Yes-1, No-2)

11. How do you dispose children's faeces (under 3 year)? (put in the latrine-1, put/ rinsed into drain or ditch-2, thrown into garbage-3, not applicable-4)

12. The drainage arrangement for waste water: (no drainage-1, open katcha-2, open pucca-3, covered pucca-4, underground-5

13. Sewerage system: (underground sewer system-1, no underground sewer-2)

14. Garbage disposal: (collection by the municipality/corporation-1, collection by residents-2, no arrangement-3)

15. Site where collected garbage is being dumped: (Nearby house-1, outside city-2, no such place-3)

Section D. Coping Cost

	Muncipal Water Supply	**Public Tap**	**Bore-well**	**Hand-pump**
Cost of putting bore-well/hand-pump/pump for storing				
Time of pumping (in minutes)				
Maintenance cost				
Type of storage devices (bucket-1, ground tank-2, overhead tank-3)				
Capacity (less than 200 litres-1, less than 200 and more than 500 litres-2, less than 500 and more than 1000 litres-3, more than 1000 litres-4)				
Cost of storage tank				
Water tariff				
Perception about the quality of water: (not safe at all-1, not so safe-2, quite safe-3, very safe-4, can't say-5)				
Use of water purifying method (yes-1, no-2)				
(boiling-1, add bleach/chlorine-2, use water filter (ceramic, sand, composite etc.)-3, use electronic purifier-4, others-5)				
For boiling (LPG/electricity/kerosene/wood/others)				
Installation cost of water purifier				
Cost of purifying water (per month)				
Reason for not purifying water (not enough time-1, not enough money-2, water is good enough-3, use bottled water-4, others-5)				
Cost of buying water (no. of bottles* price)				

Section E. Health Cost

1. Do you think that quality of water is important for the health of your family?

   (yes-1, no-2) ☐

2. How do you know that the quality of water is important for the health? (by newspaper-1, by television-2, by radio-3, others-4) ☐

3. Does the household have any health insurance? (yes-1, no-2) ☐

4. Have you or your children suffered from any illness in last 2 weeks? (yes-1, no-2) ☐

5. Have you or your children suffered from water-borne disease due to contaminated drinking water in last two weeks? (yes-1, no-2) ☐

6. Which source of health care you often use? (Public-1, Private-2, NGO or trust hospital-3, Unregistered local practitioner (Hakeem)-4, none of these-5) ☐

7. Why do you not use government hospital? (No nearby facility-1, Health personnel often absent-2, Waiting time too long-3, Procedural complications-4, Poor quality of care-5, medicine not provided-6, other-7)

8. What strategies do households use to cope with the financial costs of illness? (Using cash and savings-1, Sale of assets-2, Loans-3, Borrowings from friends/relative-4, Income diversification-5, Reducing consumption/expenses-6)

Disease #	Name (No.) of Member	Duration##	Frequency in one month	Treatment outlet*	Medical Expenses		Hospitalization Cost	Transport Cost	Loss of days** & wages		Defensive Expenditure		Loss of Leisure Activity (Informal care)		
					Doctor's fee	Cost on Medicine			Days	Wages	Item	Costs	Activity	Days	Cost

Diarrhoea-1, Cholera-2, Typhoid-3, Enteritus-4, Bacterial dysentery-5, Malaria-6, Jaundice-7, Skin & eye infection-8, Intestinal helminth infection-9, Trachoma-10, Dengue-11, Tuberculosis-12, Others-13

Less than 15 days (Acute)-1, 15 days to 3 months (Semi-cronic)-2, More than 3 months (Cronic)-3

* Traditional medicine-1, Traditional doctor-2, Shop-3, Hospital/clinic/health center-4, No treatment sought-5

**Days away from work / school (or could not do any work at home)

If mortality within one year

Name	Disease	Expenditure on treatment	Monthly Income

Section F. Income & Expenditure Pattern

1. Income by All Sources (for one month)

Source of Income	Gross Income (in Rs.)	Total Costs (in Rs.)	Net Income (in Rs.)
Agriculture and Allied			
Business and Trade			
Household Industry			
Wages and Salaries			
Rent from Land / House			
Pensions			
Others (specify)			
Total			

2a. Non-Durable Expenditure of Households (for one month)

Items	Quantity (in Kg)	Value (Rs.)
Cereals(Rice, Wheat etc)		
Pulses(Arhar, Moong, urd etc)		
Milk and Milk Products		
Vegetables(Potato, Tomato, Cabbage etc)		
Edible oil (mustard, groundnut, coconut etc)		
Sugar, salt & spices, Beverages (tea, coffee, etc.)		
Cooking Fuel (Wood/Kerosene/LPG)		
Toilet articles (soap, toothbrush, cream etc)		
Pan/ Tobacco/ Intoxicants (Ganja, toddy, liquor)		
Water Bill		
Electricity Bill		
Transportation		
Medical & health		
House rent		
Others		

2b. Durable Expenditure

Items	Consumption during the last 30 days		Consumption during the last 365 days	
	Quantity (in Kg)	Value (Rs.)	Quantity (in Kg)	Quantity (in Kg)
Clothing/ Footwear/ Bedding etc.				
Education				
Durable goods (Furniture, jewellery, cooking and household appliances, personal transport, etc.)				
Annual Maintenance				

Section G. Slum Profile

1. Is the slum notified? (yes-1, no-2) ☐

2. Number of years of notification ☐

3. Ownership of slum's land: (local government-1, central government-2, state government-3) ☐

4. Location of slum within the city: (fringe-1, central-2) ☐

5. Area around the slum: (residential-1, commercial-2, industrial-3) ☐

6. Approximate number of households in slum ☐

7. Distance to nearest government primary school: (less than 1 km-1, more than 1 km-2) ☐

8. Distance to nearest private hospital, doctor or chemist shop: (less than 1 km-1, more than 1 km-2) ☐

9. Distance to nearest government hospital or health centre: (less than 1 km-1, more than 1 km-2) ☐

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